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THE ENGINEERING SOCIETIES AND THE METRIC SYSTEM.

Many engineers complain concerning the slow progress made by the English-speaking peoples in the adoption and use of the metric system in the regular work of life. Every year finds the limits of that system more clearly defined, with the English-speaking peoples as the sole civilized supporters of an archaic medley of weights and measures that arouses both surprise and amusement in the minds of the non-English-speaking peoples. With no other possession are the English-speaking peoples in such complete isolation among the civilized inhabitants of the globe. In formulating vain regrets, however, concerning the tardiness of progress from time-honored national complexity toward international simplicity of measures, we are apt to forget that the blame is shared individually by all of us, and that no individual can escape his own personal share. Measures and measurements are not inherent in Nature, or meted out to us by our environment. They are the attributes and activities of men. As in the power of language, so in the power of measures, it is the use by individuals which constitutes authority. If we are ever to induce a change on the part of the many in either, a beginning must be made in that change on the part of a few. If no one begins, the rate of change necessarily remains zero.

Certain steps have lately been taken toward progress in this direction. It has recently been determined and officially announced by the American Electrochemical Society that, in future, all papers read before that body and containing expressions in English measure must have the corresponding metric values, to a like degree of numerical precision, inserted immediately thereafter in parentheses. Credit is due to this society for having led the way in this direction. The same rule, wherever practicable, has likewise been officially announced by the Illuminating Engineering Society as regards its papers and publications. A similar use of metric values has, it is rumored, been decided upon and officially ordered for adoption in the next six months by the American Institute of Electrical Engineers. Not even the most rabid anti-metrist can complain against the adoption of the above rule by engineering societies. The advantages of the plan are that it not only furnishes a key to foreign engineers concerning what would otherwise probably remain as pure cyphers in our papers, but it also supplies a numerical check upon the numerical statements appearing in the text. When, for instance, an electric car weighing 50 tons (45 metric tons) of dimensions 50 ft. x 9 ft. x 9 ft. (15.2 m x 2.8 m x 2.8 m) is described in a publication as being accelerated at the rate of 1.5 miles per hour per second (2.4 km per hour per second), the engineer in foreign countries ordinarily gives up all attempt at understanding the statement; but when the parentheses are supplied the statement ceases to be national, and becomes immediately raised to the international plane. We heartily recommend this practice to all engineers and engineering societies.

LIGHTING OUTDOOR ARENAS.

The lighting of the large outdoor arena of the Military Tournament at Chicago, which is described elsewhere in this issue, is interesting as one of the latest and best-planned attempts to light successfully a large outdoor field at night for amusement purposes. The lighting of arenas of this kind for military maneuvers, Wild West shows and the like, by means of a large number of lamps of high candle-power hung comparatively low over the arena has heretofore often proved unsatisfactory. In the present case the illumination provided on the field probably much exceeds that in most previous attempts. With flaming-arcs hung 35 ft. above the ground with a power expenditure of about 0.18 watt per square foot, we come close to indoor lighting practice, as the approximate observed average intensity of 1 foot-candle shows. The installation was creditable to its designers as representing one of the best planned attempts at arena lighting yet installed. But an evening's observation of the results forces the conclusion that there is yet room for much improvement in the lighting of such space.

Much has been stated recently about the effect of bright lamps in the range of ordinary vision, and with this in mind one might be led to expect considerable discomfort in facing a field with flaming-arc lamps 35 ft. above the ground. Such was not the case, however, as far as the ordinary observer with normally strong eyes was concerned, as the opal diffusing globes and the long distances from the lamps to the eye successfully prevented noticeable glare effects. There was, however, a very marked detrimental effect of another kind. Even on a perfectly clear night and immediately following a dust-laying rain, the field to the ordinary observer looking across it appeared to be enveloped in a kind of haze or mist. An experiment made by shading the eyes so that they received less direct light from the lamps greatly reduced this apparent mist, the amount of decrease in the effect being dependent directly on the amount of the shading of the eyes from the direct rays of the lamps. An efficient way to shade the eyes is by the use of a short black tube, but as it is unlikely that the public will ever be educated to the point where it will carry shading tubes to an event of this kind to enable it to see better, the conclusions are obvious that better shading of lamps should be studied in the future in connection with work of this kind. If flaming-arc lamps are used of the usual type with inclined electrodes in which the arc is located in the upper part of the globe, properly designed hoods or reflectors for such lamps would have the further advantage of permitting the use of clear globes. On account of the small amount of vertical space taken up by the arc, the shading of the arc would, on the whole, be less difficult than the shading of the long vertical tungsten filament, which has already been successfully accomplished in indoor work of this general class.

THE WIRELESS DETECTIVE BUREAU.

A new and sensational application of wireless seems to have reached its climax in the search for an alleged murderer on the transatlantic steamers during the past week. Time was when the evildoer would grow whiskers, put on dark spectacles and slink aboard some craft bound for an unexpected port, with strong hopes of getting there and departing safely; but wireless has changed all this and the interesting part of the present search is the report, whether true or false, sent from a steamer in mid-ocean as to the presence of two suspected passengers, for whom the police will be waiting with open arms upon the ship's arrival in port. In other words, it has come to this, that a search for a criminal is not the least impeded by the fact that he has taken ship, if only the wireless is working well. If his temporary home is equipped with wireless he might even be summarily arrested and clapped into irons by the captain on the request of the authorities on either side to wait securely until the arrival at port—which action, indeed, is reported by wireless to have been taken in the case of an alleged London murderer and his accomplice, now at sea. One can recall not a few searches for criminals in bygone years which would have been greatly facilitated had wireless messages then been possible. There is, of course, a possibility of mistake from telegraphed means of identification. In the case which prompts this note it may even chance that a couple of relatively innocent persons have been summarily seized by the police, but it is at least evident that the distinction between sea and land is in large measure lost and there may be risk to absconders even in retiring to the fancied security of Tangier or other port of refuge. One must own, however, that while the conquest of the sea by wireless is rapidly extending, it is not yet complete. A steamer may be in touch directly or by intermediaries with the shore every day of the trip along the well-known Atlantic lanes, but any considerable departure from a few crowded courses means that the intermediaries have disappeared. Although the range of wireless is by no means unlimited, it is at the present time sufficient to cover the Atlantic and even the Pacific thoroughly from a few well-selected stations, and this is the first great work which the wireless companies or the respective governments ought to undertake in order that a steamer equipped with wireless service would never be out of touch with one of the network of stations. As it now is, a steamer may readily be driven out of her course and disabled so as to be as completely out of reach for many days as she would have been before wireless was thought of. This condition should be remedied and remedied at once merely for the safety of the world's commerce, and incidentally perhaps for a more complete and world-wide detective system than even the present exigency succeeded in disclosing.

SPACE DISTRIBUTION OF MAGNETOMOTIVE FORCE.

The similarity in operating phenomena of the induction motor to the stationary transformer as well as to the shunt-wound direct-current motor and alternating-current generator has been the means of simplifying to a remarkable extent the theoretical treatment of the first-mentioned machine. It has also been the cause of certain inaccuracies, which, however, are of a quantitative rather than a qualitative nature. These facts are well illustrated by the numerous discrepancies found in the values given by various writers for the relation between the core flux and the magnetizing current, or ampere-turns per phase winding. Almost all of the writers have based their treatments upon the transformer features of the machine, the discrepancies being attributable to differences in values assumed for the flux and for the space and time relation of the component and resultant m.m.fs. Certain of the writers tacitly assume an open secondary circuit and "stepped" space distribution of the flux, assign to the flux that value demanded by the

counter e.m.f., and determine the component or resultant m.m.f. for producing this flux. Others imply the existence of a flux sinusoidally distributed in space and calculate the m.m.f. for producing the maximum value of this flux. All of these writers take into account the differences in time-values of the component m.m.fs., and a few of them consider the space distribution of the ampere-turns of the separate phase windings, but almost none make allowance for the effect of local secondary currents upon the space distribution of the flux over the primary core and upon the maximum value reached by this flux.

A discussion of the above discrepancies and one of the causes therefor is given in this issue in an article by Prof. B. B. Brackett. The author finds that much confusion of terms and inaccuracies in results are caused by the failure to recognize the space distribution of the m.m.f. Attention should be called to the fact that the author has treated the problem as purely one of transformer action with open secondary. When the secondary is closed the wave-shape of the space distribution of the flux is similar in all respects to the wave-shape of the time-value of the impressed e.m.f., and the m.m.f. to produce this space distribution is the resultant of currents in the secondary and primary circuits. By assuming the secondary to be closed and treating the machine as a revolving-field, counter-voltage generator, one can easily determine the maximum instantaneous value of the flux at any point from the space distribution of the conductors and the e.m.f. that must be counter-generated therein. It is customary to calculate the core loss watts from the volume of the core and the maximum flux density throughout each part thereof. An exactly similar method can be employed for determining the wattless exciting volt-amperes from the volumes of the core and the air-gap, the maximum flux density in each part and the permeability of the material for each density, that for air being unity at all times.

ADJUSTABLE-SPEED ALTERNATING-CURRENT MOTOR.

The numerous advantages of the polyphase induction motor over the direct-current motor for constant-speed service are thoroughly appreciated by all electrical engineers. Moreover, its few disadvantages for constant-speed service and its many shortcomings when used where adjustable speed is desired are well understood at the present time. The excitation of the direct-current machine represents, say, 1 per cent continuous loss in the resistance of the magnetizing coil, but the energy for the magnetic field after it has once been established remains stored therein without affecting the external circuit in any way. In the case of the induction motor there is an even greater mean power loss in the resistance of the magnetizing coil and a transfer of energy to and from the magnetic field from and to the external circuit during each alternation of the impressed e.m.f., the amount given to the magnetic field being somewhat less than that returned therefrom. Thus the excitation of this machine represents a power loss in the copper, a power loss in the iron and a consumption of wattless volt-amperes for maintaining the magnetic field. Although the volt-amperes taken by the machine at no load may reach even 30 per cent of the amount consumed at full load, yet the machine possesses so many other features that are highly advantageous that this disadvantageous feature is considered insufficient to prevent its wide adoption for constant-speed service.

The simple revolving-field induction motor is essentially a constant-speed machine, although it can be caused to exert its full-load torque at any speed from standstill to the normal running value. The most convenient method of reducing the speed is by inserting resistance in the secondary circuit, the "slip" for any chosen value of torque varying directly with the total resistance of the secondary circuit. This method possesses two disadvantages, namely, low efficiency on account of the loss in the inserted resistance and poor speed regulation under fluctuating loads, the latter being particularly disadvantageous where truly adjustable speed is desired. Two methods of speed variation which result in a fairly high efficiency and well-defined adjustability of speed are found in the use of pole-changing arrangements and in the employment of cascade or tandem control. The results obtained from these two methods are fairly comparable; each is limited in the number of steps of speed changes, and each requires an excessive amount of wattless volt-amperes at low speed. The former method involves the use of a machine specially constructed to produce different numbers of magnetic poles, while the latter requires at least two separate motors for carrying a single load.

A method closely related to the last named, but one in which certain of the limitations just noted are removed, is described in the Digest of this issue. The second machine of the cascade set is a variable-speed, adjustable-speed or constant-speed polyphase commutator motor. This machine receives the energy from the secondary of the induction motor and, instead of dissipating it as would be done if resistance were inserted in the secondary circuit, delivers most of it as mechanical work at any place desired. Interest centers chiefly around the construction of the polyphase commutator motor. The rotor winding is similar to that of the armature of a direct-current machine. The stator winding consists of "compensating" coils for each phase in addition to the exciting coils. The compensating coils perform the double function of neutralizing the m.m.f. of the armature current and counterbalancing the e.m.f. generated in the armature by the alternation of the field flux, being joined in series with the armature for this double purpose. Evidently the e.m.f. between the terminals of the armature and the compensating-coil circuits varies solely with the product of the field flux and the speed of the rotor, and is independent of the frequency. The machine can be given any of the load-speed or voltage-speed characteristics possessed by any type of direct-current motor by the proper arrangement of the exciting coils; moreover, the load-speed characteristics of the commutator motor are imparted to the whole cascade set, so that the speed control of the equipment is equally as simple as that of an installation of direct-current motors. Both the value and time-phase of the counter e.m.f. generated by the commutator motor are adjustable at will. When the e.m.f. is in direct time-phase opposition to the secondary e.m.f. of the induction motor, only the speed of the set is affected; when it is in time-quadrature therewith, only the excitation of the induction motor is affected. By proper adjustment of the e.m.f. the whole of the excitation may be supplied by the commutator machine, and the set will operate at unity power-factor. No details are available as to the methods employed for eliminating sparking, but it is reported that the machine commutates satisfactorily. The chief disadvantage resides in the cost, which would be prohibitive in many installations.

National Electrical Contractors' Association.

The tenth annual convention of the National Electrical Contractors' Association was held at Atlantic City on July 20, 21 and 22, 1910. The headquarters were at Young's Hotel and the meetings were held on the Million-Dollar Pier. There were no exhibits of electrical apparatus or devices this year, as this feature of conventions has not been encouraged to any great extent by the contractors' association for the last three or four years.

The convention was opened with an address of welcome by Hon. Franklin Stoy, Mayor of Atlantic City, who in a few well-chosen remarks welcomed the delegates and their friends and conferred on them the freedom of the city. Mr. G. M. Sanborn, president of the National Electrical Contractors' Association, appropriately responded. Among the papers read and discussed at the convention were the following: *Fire Insurance Supervision of Electrical Installation,* by Mr. Washington Devereux, chief inspector, Philadelphia. *Electrical Inspection,* by Mr. G. E. Bruen, New York City, representing the National Fire Protection Association. *Welfare,* by Mr. Louis B. Schram, chairman committee on factory inspection of the National Civic Federation; this paper dwelt on the means for safeguarding wage earners against industrial accidents. *Relations Between the Architect and the Contractor,* by Mr. William A. Boring, architect, New York City.

The feature of the convention was the address by Mr. Charles L. Eidlitz, past-president of the National Electrical Contractors' Association. Mr. Eidlitz's annual address at these meetings is always looked forward to by contractors on account of the shrewd advice and fruitful suggestions contained.

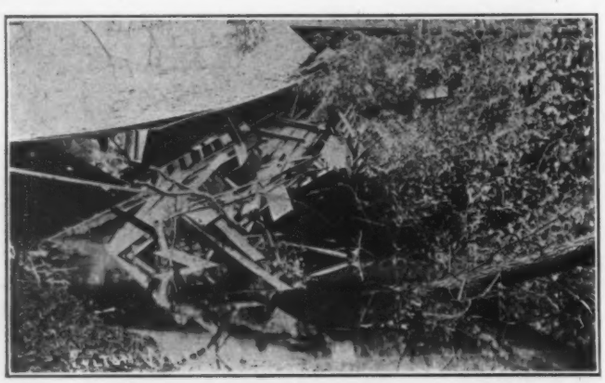
The officers elected for the ensuing year are as follows: Mr. Marshall L. Barnes, of Troy, N. Y., president; Mr. C. R. Kreider, of Chicago, first vice-president; Mr. H. C. Potter, Boston, second vice-president; Mr. J. C. Hatzel, New York, third vice-president.

It was decided to hold the next annual convention at Niagara Falls. It was left to the executive committee to decide whether the meeting will be held in the Hotel Clifton on the Canadian side or at some hotel on the American side.

The Sons of Jove held a rejuvenation during the convention on the evening of July 21 at the Windsor Hotel following an elaborate dinner. About 30 new members were initiated and the affair was one of the pleasant features of the convention. Bro. H. B. Kirkland and Bro. Frank H. Stout had charge of the ceremonies.

Unusual Accident to Water-Power Plant.

A rather unusual accident occurred recently in the Fulton hydroelectric plant of the Janesville Electric Company, of Janesville, Wis. This plant is located on the Yahara River,



View of Destroyed Water-Power Plant.

about 12 miles from Janesville, and is operated at 14-ft. head. Electrical energy generated here is transmitted to Janesville, where the principal office of the company is located.

The plant at Fulton had an old wooden flume and the company has for some time been considering the replacement of this flume by a reinforced concrete structure, plans for which were under preparation. A leak in the flume was the cause of the bottom dropping away from the side walls, and the rush of water through this gap cut away the ground from under the generator room, which collapsed and fell through the cavity with all of its contents. The accompanying illustration is a reproduction of a photograph showing the damage done by this unusual washout, it being estimated that several thousand dollars will be necessary to make the plant effective.

Since Fulton is one of the four water-powers which the company owns, the service was not crippled in any way. It is expected that the damage will be speedily repaired.

Extension of Chicago's Street-Lighting System.

Negotiations are still under way between the city of Chicago and the Sanitary District in relation to the details of the agreement by which the Sanitary District will finance and maintain an extension of 10,000 arc lamps to the existing street-lighting equipment of the city of Chicago. The main outlines of the proposed contract have been settled and there seems to be little doubt that the plan will be carried into effect. However, the finance committee of the City Council is desirous of effecting some changes in the agreement as tentatively adopted, and these changes are now under discussion. It is possible that a form of ordinance will be accepted by both sides to be presented at a special meeting of the council to be held within a week or so. Among the amendments now under discussion are the following:

Extending the terms of the contract so that the city may purchase energy for building illumination and power for use in operating bridges and even pumping stations, if electrical operation is later thought advisable.

Giving the city, as well as the sanitary district, the right to cancel the contract in the event of default by the other party.

Giving the city in exchange for its granting the district the right to use the municipal poles and conduits the right to use the district's equipment of this nature.

Adding a stipulation that the sanitary district's lien against the lighting equipment shall not hold if it is in default.

Defining more closely that the district accepts the city equipment in its present condition.

Making the payments by the city contingent upon the tax levy and the annual appropriation bill's passage.

Power Development on the Wolf River.

The Wisconsin Traction, Light, Heat & Power Company, with which Mr. John I. Beggs, president and general manager of The Milwaukee Electric Railway & Light Company, Milwaukee, Wis., is prominently identified, has purchased water-power rights on the upper Wolf River in Northern Wisconsin and intends, at some future date, to develop this power and transmit it by electricity. The necessary land has been secured near Gardner's Dam in Langlade County, about 70 miles from Appleton. The power that will be developed there will be used by the interurban railway system operated in the Fox River valley by the Wisconsin Traction, Light, Heat & Power Company. Electrical energy will also be sold for other purposes without doubt. It is said that the company will spend over $1,000,000 in this improvement, although no time has been set for the beginning of operations.

St. Louis Electrical People at a Picnic.

A party of about 300 persons, made up of members of the League of Electrical Interests of St. Louis and ladies, attended an old-fashioned basket picnic at Valley Park on Mera-

mec River, 19 miles from St. Louis, on July 16. Every person wore a circular tag giving his name and that of his company connection if there was one. There was music by an orchestra during the day and all sorts of games and amusements. In the afternoon there was an exciting ball game at which the "Negatives," headed by Mr. F. D. Beardslee, lost to the "Positives," led by Mr. T. C. Laufketter, by a score of 4 to 3. The prize for winning this game was a box of cigars, and in it were about 12 cigars with "short-circuits" which could not be repaired. During the evening there was a prize waltz which was won by Miss Ryan and Mr. Leo Comisky, of the Jandus Electric Company. Mr. James Dorney, of the Westinghouse company, with Mrs. Dorney, captured the two-step prize. Another prize-winner was Miss Huebler, who won the ladies' accurate ball-throwing contest.

There was a court to handle all cases of "talking shop," and several "criminals" were prosecuted by "Judge" L. M. Sperry and defended by Mr. W. E. Rapp. The presiding judge was Mr. R. J. Russell, of the Century company. Fines of $5.00 were imposed, and, according to the terms of the sentence, this money was expended in sodas and other light refreshments for the ladies. Canoeing, bathing and other recreations were enjoyed. Mr. C. E. Brenton, auditor of the Union Electric Light & Power Company, was missing for a long time, and after a prolonged search was finally found at a distant point on the river quietly gazing at reflections in the water. Some one started the story that Mr. Brenton was looking at other reflections than his own. The country around Valley Park has many romantic spots, and many members have a longing to return, provided good company can again be secured.

The outing was the first of several to be given during the summer season. It was entirely successful, and credit is due the various committees. Mr. L. M. Sperry was master of ceremonies, and the chairmen of the various committees were: Transportation, Mr. J. R. Cullilane; grounds, Mr. F. Johnson; prizes, Mr. J. P. Casey; program, Mr. R. J. Russell.

Annual Report of City Electrician of Los Angeles.

Some interesting facts are contained in the annual report of Mr. R. H. Manahan, city electrician of Los Angeles, Cal., recently filed with the board of public works of that city. The report covers the year ended June 30, 1910, and shows that the cost of electric street lighting in Los Angeles was $272,133.48. Of this amount, $216,605.53 was paid by the city for street arc lighting, while property owners paid $22,372.80 for special ornamental street lighting. The number of permits issued for electrical construction and repair work was 14,782, representing an increase of 32 per cent over the year before.

Mr. Manahan calls attention to the fact that more assistance is needed in the department of electrical inspection, which has to cover a territory of 100 sq. miles. He recommends that all wires should be enclosed in conduit in the fire district and in all public buildings and large apartment houses outside of the fire district. Attention is called to the fact that petitions have been presented for the ornamental lighting of Pico Street, from Main Street to Vermont Avenue, 1.97 miles; Seventh Street, from Boyle Street to Hoover Street, 4.13 miles; Sixth Street, from Main Street to Alameda Street, 0.81 mile; Third Street, from Main Street to Hill Street, 0.21 mile, and First Street, from Hill Street to Chicago Street, 2.10 miles. The present mileage of this type of street lighting is 6.8 miles, and with the extensions enumerated above the total will be about 16 miles of special ornamental street lighting.

During the year the report shows that 221 street arc lamps were installed, making a total of 2804 lamps in the old city proper. There are still a number of streets in Los Angeles that are poorly lighted, and Mr. Manahan recommends that at least 400 additional street lamps be placed in position during the present fiscal year. These new lamps will cover, as far as possible, the unlighted sections in the recent annexations as well as the city proper. The city electrician notes that Hollywood is lighted throughout by 50-watt tungsten lamps under a five-year contract and he suggests a revision of this contract by which the city may secure a more advantageous rate, at the same time assuring the company a fair return on its investment.

To Prevent Unauthorized Climbing of Poles.

Several accidents having occurred in Chicago due to boys climbing poles carrying high-tension wires, the subject was brought up in the City Council, and the city electrician was instructed to make an investigation. Under date of July 11 Mr. William Carroll, the city electrician, has made his report on this subject. He mentions that in the Twenty-seventh Ward of Chicago and elsewhere the Sanitary District maintains poles supporting wires carrying a voltage of 12,000 volts or more. It is possible for children to climb these poles and receive an electric shock causing serious injury and possibly death. Mr. Carroll reports that he has conferred with the electrical engineer of the Sanitary District on the subject and that both have agreed that it is difficult to provide safeguards on poles which will allow linemen to climb them and at the same time prevent irresponsible persons from doing so. However, he believes that conditions can be improved by making the poles more difficult to climb by persons not provided with linemen's spurs. The Sanitary District is now arranging to equip one or more of its poles with a device which will make it almost impossible for anyone to mount the poles unless aided by the spurs used by linemen. It is proposed to wrap the poles with galvanized-wire mesh to a height of 15 ft. or 20 ft. If this method proves satisfactory, all of the Sanitary District's angle-iron poles located within the city will be similarly protected. In conclusion, Mr. Carroll recommends that an ordinance be passed making it a misdemeanor for unauthorized persons to climb poles or other structures of any kind carrying electric wires or conductors of any description. The report was referred to the committee on judiciary of the City Council.

Water-Power Possibilities in Government Waterway Plans.

In the Rivers and Harbors bill passed at the recent session of Congress and approved by President Taft are several provisions for improvements of internal waterways which may result in making water-powers available for industrial purposes. For the construction of a waterway from Lockport, Ill., by way of the Des Plaines and Illinois rivers, to the mouth of the Illinois River, $1,000,000 is appropriated. The Secretary of War is to appoint a board of five members to be composed of four engineer officers of the army and one civil engineer taken from civil life. This board shall report on the feasibility of the proposed waterway and the manner in which it should be built, in case it is recommended. It will also consider other aspects of the subject, such, for instance, as the possible lowering of the level of the Great Lakes by reason of the construction of the waterway.

After conference with the authorities of the State of Illinois, the board shall report upon the extent to which the United States may co-operate with the State of Illinois in the construction of a navigable waterway from Lockport to the mouth of the Illinois River in conjunction with the development of the water-power by the State authorities between Lockport and Utica, Ill., for which the people of the State have authorized their General Assembly to appropriate $20,000,000.

Should the board consider co-operation with the State to be desirable, it is directed to prepare plans and estimates of the cost of the work recommended to be done by the United States alone or in co-operation with the State of Illinois. Until these plans and estimates have been submitted and a project for the improvement adopted by Congress, the appropriation of $1,000,000 mentioned above is not available for expenditure.

The board of engineers is also directed to consider and report upon the improvement of the Mississippi River between

the mouth of the Illinois River and the mouth of the Ohio River by the construction of a dam at or near Jefferson Barracks, and a dam at or near Commerce, and the development of water-power incidentally created by such dams. Jefferson Barracks is 8 miles below St. Louis and Commerce is 36 miles above Cairo, Ill. The law requires that the reports called for from the engineering board of five men shall be submitted to the chief of engineers of the War Department not later than Nov. 1, 1910.

If these projects are carried out a large water-power will be developed in the Illinois River, perhaps near Utica, Ill., while considerably larger water-powers—no doubt over 100,000 hp in each case—will be developed at the proposed dams at Jefferson Barracks and Commerce, where the great volume of the Mississippi River will be available. When these great engineering undertakings are carried to completion, the energy of the developed water-power will be transformed into electricity, no doubt, and so transmitted and distributed for industrial use.

Another water-power project mentioned in the Rivers and Harbors act approved June 25, 1910, relates to the improving of the Mississippi River from St. Paul to Minneapolis. The modified project recommended by the chief of engineers in his report dated March 3, 1910, is formally adopted and all future work on this improvement must be carried out in accordance with this report. In the making of leases for water-power under the provisions of this project a reasonable compensation must be secured to the United States and the rates as fixed are subject to revision by Congress.

Annual Meeting of Massachusetts Electric Lighting Association.

The annual meeting and dinner of the Massachusetts Electric Lighting Association was held at the Tedesco Club, Swampscott, Mass., on July 7, about 50 persons being present. President C. L. Edgar was in the chair. After the usual routine business, resolutions were passed regretting the death of the late Gen. A. B. R. Sprague, of Worcester, who had been a vice-president of the Association. The following officers were then elected for the ensuing year: President, Mr. C. L. Edgar, Boston; vice-presidents, Messrs. C. F. Prichard, Lynn, and A. F. Dow, Fall River; secretary, Mr. E. W. Burdett, Boston; executive committee, the foregoing gentlemen and Messrs. F. S. Pratt, Boston; R. W. Day, Springfield; A. E. Childs, Boston; A. B. Tenney, Boston; George T. Dewey, Worcester, and J. W. Stevens, Greenfield.

LEGISLATIVE WORK IN MASSACHUSETTS DURING 1910.

The twenty-first annual report of the executive committee, which was then read by the secretary, reviewed the history of legislative work during the session just closed, with special reference to the central-station industry. The committee reported that the year closed without the passage of any legislation hostile to the interests of the association. Some of the matters before the Legislature were of the same general character as those of previous years, while others were novel in their character.

Upon the question of municipal ownership three important bills were presented. The first was similar to bills presented in previous years, seeking to reduce the legal requirements for the establishment of a municipal plant in a city to a single vote of each branch of the City Council, ratified by a single majority vote of the voters at an annual or special election. This bill was withdrawn.

Another bill sought to authorize any two or more manufacturers or merchants to unite or co-operate in supplying each other with electric service, upon receiving permission to do so from the Board of Aldermen or Selectmen. The passage of this bill would, of course, have thrown the business open to any two or more persons who might see fit to unite for that purpose and would practically have constituted a repeal of the entire body of the present law relating to electric lighting in this State. The bill was unfavorably reported and adversely acted on.

Another bill, introduced on petition of a representative of the city of Haverhill, while preserving some of the forms of the present law, would have, in fact, if enacted, put the companies entirely at the mercy of the towns and cities in which they operate. It provided that a city or town might establish a plant for municipal or commercial purposes, either by the purchase of an existing plant or by the installation of a new municipal plant, at its option. It further provided that the company might offer to sell its existing plant to the city, but it specially provided that the city or town should be under no obligation to purchase. The city solicitor of Haverhill appeared, among others, in advocacy of the bill, under instructions from his city government. The legislative committee asked leave to withdraw the bill, and the House refused substitution after debate and roll call. The result, if this bill had been enacted, is made very plain by the fact that since it was defeated the city government of Haverhill has taken final steps toward the establishment of a municipal plant, but under the existing law the right of the company to sell its plant to the city at its fair market value for the purposes of its use is fully preserved.

On petition of a representative from the city of North Adams two bills were considered with respect to charges for meters; one to prohibit or regulate the charges for the use of gas meters, and the other to prohibit or regulate the charges for electric meters. The latter bill sought to make it unlawful for any company to make any charge for a meter or for anything except electricity actually used. This bill arose out of the recent institution of meter charges in North Adams, which had not previously been in force. It was advocated principally by citizens and officials of that city, but was opposed not only by counsel for the Massachusetts Electric Lighting Association, but by the Municipal Electric Lighting Association also. Neither bill became a law.

The Board of Gas and Electric Light Commissioners made several recommendations, which resulted in the following enactments:

Chapter 124: That the provision of the Revised Laws authorizing a change in the character of the business of a corporation by a vote of all its stockholders, as applied to gas or electric lighting companies, shall not authorize gas companies to engage in the business of making or selling electricity unless authorized so to do by the Board of Gas and Electric Light Commissioners, and that electric service companies shall not engage in the business of making or selling gas at all. It is difficult to suggest any reason for any such distinction between gas and electric companies, but the matter seemed not to be of sufficient practical importance to justify strenuous opposition to the measure.

Another act passed on recommendation of the gas commissioners was chapter 197, that the provisions of the Revised Laws authorizing a company confined by its charter or agreement of association to doing business in a particular city or town to extend or remove its business, or any part thereof, to any other city or town in the State shall not apply to gas or electric light companies, except that the gas commissioners may authorize such a corporation to carry on the business for which it was incorporated in a city or town other than that named in its agreement of association or charter. This act has no application except to companies whose operations are confined to a given territory by the express provisions of their charters or agreements of association.

A bill was introduced primarily in the interests of a transmission company seeking to obtain for electric service companies the right to erect and maintain transmission lines over private lands, with authority to exercise the right of eminent domain under certain conditions. Other bills were introduced seeking to secure very much enlarged rights of appeal to the gas commissioners from the action of aldermen and selectmen with respect to the locations and operations of electric service companies. One of these bills went so far as to give the right of appeal in all cases of refusal by local authorities to grant locations upon application.

While none of these bills was enacted in the form in which

it was introduced, they were made the basis of a resolution providing for an investigation by the Board of Gas and Electric Light Commissioners into the whole subject of the conditions and laws affecting the transmission of electricity in public ways or over private lands. This resolution offers what is believed to be a valuable opportunity for the thorough investigation and study of what has become a most vexatious and uncertain condition of the law affecting the rights of companies in the transmission and use of electricity in this State and the securing of remedies therefor. This matter had become so serious that a bill was introduced in the interests of the members of the electric lighting association in 1908 looking toward a similar investigation, but was subsequently withdrawn.

The utmost confusion and uncertainty now exist with respect to many of the operations of the companies in the use of public streets for their poles, wires and conduits. Probably a large proportion of the locations are more or less defective and may constitute public nuisances. In case of injury arising from the presence of these structures in public streets, the owners will be practically helpless in suits for the recovery of damages for such injuries either to persons or property. The right to transmit energy at high voltage through one town to another has also become a matter of first importance in some cases. All of these things are to be investigated by the Board of Gas and Electric Light Commissioners, who are required to report the results of their investigations, with such recommendations for legislation as they may deem advisable, to the next General Court. It is hoped that results of high importance to the companies may be worked out by means of this investigation.

An increase in the salaries of the Board of Gas and Electric Light Commissioners was proposed early in the session, and received the support of the association. Whether higher salaries always produce better men in public employment may be open to serious question, but it is certainly true that they have a tendency to do so. Chapter 539 increases the salary of the chairman from $4,000 to $5,000, and that of the other commissioners from $3,500 to $4,500 each, from and after July 1, 1910.

Conflicts of interests have heretofore arisen owing to the provision of law that the right to subscribe for shares of increased capital stock belongs to those who were stockholders at the time of the vote to increase. As there was no express authority of law to vote to increase the capital after the action of the Board of Gas and Electric Light Commissioners authorizing such increase, considerable periods of time sometimes elapsed between the date of the vote to increase and the date when the shares were offered to stockholders. To remedy this and other difficulties a bill was agreed upon, after a good deal of discussion between the representatives of the electric lighting association, the gas commissioners and others, which became law as chapter 374. This act provides that the vote to increase the capital may be passed either before or after the application to the gas commissioners for the necessary permission to do so, but that no such application shall be made except upon vote of the stockholders. The act further provides that the rights to new stock shall accrue as of the date of the vote to increase the capital, whether passed before or after the action of the gas commissioners, but it requires that in order to be valid notice of the increase shall be given to stockholders within 60 days after the final action of the board.

One of the most, if not the most, important matters that was pending in the last Legislature was the proposed amendment to the constitution striking out the requirement that all taxes shall be "proportional," as well as reasonable, and giving the Legislature the power to classify property for the purposes of taxation. This was known as the "three-mill" amendment. A special board, of high character, had investigated this subject and had reported adversely upon it. The necessary resolution was, however, adopted by the Legislature in 1909, and, if it had been readopted by the Legislature of 1910, would have gone to the people for ratification at the next annual election.

The special commission above referred to predicted great disturbance of values of domestic stocks and bonds in case of the final adoption of the amendment, as well as constant agitation for special classifications for taxation of different kinds of property. They said: "The provisions of the tax laws might easily in the course of time be elaborated into the extreme complexity of a tariff act, with innumerable classes and rates. The situation would be a constant menace to stablity of values."

Certain mercantile and manufacturing interests of the State were very open and active in their advocacy of the amendment, but it finally failed of passage.

A resolution was introduced by the Public Franchise League of Boston to provide for an investigation of voluntary trusts or associations controlling the capital stock of public-service corporations. This was debated before the committee on the judiciary, which reported almost unanimously against it. The House chairman of that committee, however, secured a substitution of the resolution for the report of the committee in the House; however, it was finally defeated in the Senate.

A very elaborate bill was introduced, looking to the creation of a new public service commission for the control, supervision and investigation of all the public-service corporations of the State, and the abolition of the existing State commissions now dealing with the different classes of public-service industries. The bill consisted of 89 sections, modeled on the laws of another State. It did not meet with the approval of the committee or the Legislature.

After extended negotiations between the representatives of the city of Salem and the different public-service corporations operating therein, an act for the placing of wires under ground in the congested portion of that city was agreed upon, reported by the committee, and enacted by the Legislature. When it reached the Governor, however, objection was made by the board of gas commissioners to a provision of the bill that the companies interested should be allowed to capitalize the future cost of moving, changing, repairing or replacing any part of the underground conduits, ducts, cables or manholes to be laid pursuant to the requirements of the act by reason of any change in or removal of the Salem railroad tunnel, or of a change in the location or grade of the railroad, or of the abolition of grade crossings in the city. The amount to be capitalized for such purposes was the actual and reasonable cost, as determined, after public notice and hearing, in the case of an electric light company by the gas commissioners, in the case of a telephone or telegraph company by the Massachusetts Highway Commission, and in the case of a street railway company by the railroad commissioners. Although this provision of law was deemed by the parties in interest to be perfectly reasonable, covering merely the cost of removing or reconstructing new work done pursuant to the law in case of interference with it by other public improvements, the companies interested consented to its elimination from the act. The Senate accordingly recalled the bill from the Governor, and it was re-enacted without the provision referred to, as chapter 448. The provision objected to was allowed, however, to remain so far as street railways were concerned, because it was claimed that they already had the right referred to and the railroad commissioners did not object to its re-enactment in this special form.

On petition of the Pittsfield Electric Company the time for the removal and placing underground wires in a certain portion of that city was extended by chapter 318.

Other bills were presented, discussed and disposed of relating to the insulation of electric wires, fees or deposits for opening streets, old age pensions, employer's liability and labor laws, etc., but none of these required special mention.

Massachusetts Commission News.

Final hearings were held by the Massachusetts Railroad Commission on July 20, 21 and 22 upon the petition of the Boston & Eastern Electric Railroad Company for a certificate of exigency authorizing it to build a high-speed interurban railroad between Beverly, Salem, Lynn and Boston. The plans of the company have been fully described in previous issues

of this paper. At the last session of the Massachusetts Legislature the company was given the right to build a tunnel under Boston Harbor and a subway to Post Office Square for the purpose of entering the city. Interest in the final hearings centered in a new proposition by the Boston Elevated Railway Company for the use of the existing East Boston tunnel and in the arguments of counsel summarizing the reasons for and against the authorization of the road. It was stated that the Boston & Eastern company has already expended nearly $200,000 in preliminary engineering and legal charges.

The full board was present at all the hearings. On July 20, Mr. Frederic E, Snow, for the Boston Elevated Railway Company, stated that his company was willing to enter into an agreement with the Boston & Eastern by which the passengers of the latter road would be turned over to the Boston Elevated at Porter Street, East Boston, and for a 6-cent fare brought into the city by the latter company and distributed throughout the metropolitan district. Mr. Snow proposed to handle this traffic in the East Boston tunnel, with surface cars from the tunnel mouth to the Porter Street district, or else extending the tunnel to Porter Street. The latter plan, embracing about 1800 ft. would cost $500,000. Mr. Snow said that if the Boston & Eastern passengers should thus be turned over to the Boston Elevated, the latter company would transport them to their destinations more quickly than if carried to Post Office Square by the independent line and then by a foot passage brought in touch with the present Boston system. It would also save the Boston & Eastern the expenditure of $2,800,000 for a separate tunnel. Mr. Snow said that the East Boston tunnel affords almost ideal connections with the present rapid transit lines and that a separate tunnel could not properly distribute the incoming traffic. He thought that the Boston & Eastern could afford to reduce its fares at least 30 per cent if it was not required to build a tunnel.

Corporation Counsel T. A. Babson, of the city of Boston, pointed out that the city desires a fuller use to be made of the East Boston tunnel. He repeated his opinion that the Boston & Eastern would cut into the earnings of that tunnel and postpone the day when the penny toll could be discontinued. He felt that there is no real protection to the city against the failure of the Boston & Eastern company to fulfill its obligations. The Law Department of the city was in favor of the Boston Elevated plan. Mr. Snow then took the floor for a moment and stated that he was prepared to show that the capacity of the existing tunnel is not fully utilized, if the Commission desired it. The present cars run in the tunnel seat 52 passengers each, and the average number carried is 30.

On July 21, Mr. Woodward Hudson, for the New York Central Lines and Mr. Benj. N. Johnson, for the General Electric Company, Lynn Works, argued in opposition to the granting of the certificate. Mr. William H. Coolidge, for the Boston & Maine, then submitted a long argument in opposition, claiming that the policy of the state protects transportation interests already serving the public well, and contending that the new road would seriously injure the existing roads. He urged that the Boston & Eastern could not possibly be a financial success without destroying the entire traffic of the existing lines and producing new traffic not now in sight from any source. He then presented a letter from President C. S. Mellen of the New York, New Haven & Hartford Railroad Company which stated that whether the business is profitable or not, there is an obligation upon the existing suburban routes that it shall be handled efficiently, and that "any policy which diverts the business from the existing routes, or prevents its increase to a very much greater volume than at present, simply prolongs the agony and loss to existing transportation lines, and it would seem the true policy should be to build up the business on existing lines until the volume of the same may overcome the loss now the result of rates made to attract volume and possibly future profit."

Mr. Bentley W. Warren, counsel for the Boston & Northern Street Railway Company, argued that the board should not grant the certificate unless it was convinced that the want of the new road is a great public inconvenience; that the possibility of induced travel is immaterial in a question of exigency; that the Board must be satisfied that the existing companies cannot or will not improve their facilities, before permitting the new road. He also filed requests for rulings upon legal points associated with the case.

On July 22 Mr. Warren again protested against the entrance of the new line and argued that it could not pay its way in the field. Col. Melvin O. Adams, President of the Boston, Revere Beach & Lynn Railroad, said that the Boston & Eastern would furnish ruinous competition to his line. The final argument of the case was then given by Mr. C. S. Baxter, for the Boston & Eastern. Mr. Baxter urged that the best engineers in the country have passed favorably upon the financial feasibility of the project; that the company has acted entirely within its legal rights as regards capitalization and procedure; that the commission has already committed itself to the need for the road; and that the plan of the Boston Elevated for the use of the East Boston tunnel would destroy the high-speed functions of the enterprise. The hearing was closed and the board took the case under advisement.

New York Commission News.

The Public Service Commission of the First District of New York, through its attorney, has applied to the Supreme Court to set aside the finding in the suit brought by the commission against Receiver Whitridge, of the Union Railway Company, to recover $800,000. This suit was originally brought for an alleged violation of an order of the commission directing the equipment of the cars of the company with a certain type of wheel guard. The suit was thrown out by the Supreme Court justice who tried the case, and the present application on the part of the commission is for the purpose of having it replaced upon the calendar with a view to a new trial.

The Pelham Park Railroad Company and the City Island Railroad Company have been ordered by the Public Service Commission to give four days' notice before undertaking to put into operation the new monorail road extending from Bartow station on the New Haven Railroad to City Island. This order was brought about on account of the accident which occurred at the first attempt to operate the road, and in which quite a number of people were injured. Mr. E. G. Connette, transportation engineer of the commission, is not as yet ready with his report on the accident.

Additional hearings may be ordered upon the reorganization plan of the Third Avenue Railroad Company before the Public Service Commission renders its final decision. A large number of hearings have been held since the case was opened last December and a vast amount of testimony has been taken. It is now said, however, that the commission desires to have further evidence before rendering its decision. It is considered practically certain that any reorganization plan which the commission approves will scale down the capitalization of the new company to the actual present cash value, or actual cost of reproduction of the property. Consequently, in the case of the Third Avenue company, there must be written off from the existing capitalization an amount equal to the depreciation which has taken place.

The Public Service Commission, Second District, has authorized the Olean Electric Light & Power Company to increase its common capital stock from $35,000 to $85,000 and to issue the increase of $50,000, the proceeds to be used for indebtedness incurred in additions and betterments to its plant. The conditions of the grant are that the company is required to credit to fixed capital $2,261.14, the amount charged to capital which was expended for replacements not properly the subject of capitalization.

The commission has served an order upon the Lockport Light, Heat & Power Company requiring it to show cause why an order should not be entered requiring the gas manufactured, distributed and sold by this company to equal the standard

illuminating power for coal gas. The law provides that this gas shall be of at least 16 cp. Six out of seven tests made by the commission from January to July inclusive have shown the candle-power to be less than the standard fixed by law.

CURRENT NEWS AND NOTES.

N. E. L. A. Membership.—During the past month the National Electric Light Association has enrolled 251 new members. The present total is 5791, a gain of 2654 since the convention of 1909.

Pennsylvania Electric Light Convention.—The Pennsylvania Electric Association will hold its third annual convention Sept. 14-16 at the Glen Summit Springs Hotel, on Mount Nescopec, near Wilkes-Barre. This association recently became a section of the National Electric Light Asociation.

Increase in Staff of Bureau of Standards.—The equipment and forces of the Technological Branch of the United States Geological Survey, except that employed in coal testing, has been officially transferred to the Bureau of Standards. An additional appropriation of $50,000 was made to the bureau for carrying on its new line of work.

Chicago Section of American Electrochemical Society.—A Chicago section of the American Electrochemical Society was organized July 7, with Prof. Herbert N. McCoy, of the department of chemistry, University of Chicago, as chairman, and Mr. Arba B. Marvin, 950 Commercial National Bank Building, Chicago, as secretary-treasurer.

Central-Station Incandescent Lamp Situation.—The National Electric Light Association has authorized the appointment of a committee of seven operating and technical men for the purpose of making research into the subject of lamp efficiencies and central-station rates as brought forward in a paper presented at St. Louis by Mr. S. E. Doane.

N. E. L. A. Geographic Section.—The Nebraska Electrical Association has applied for affiliation with the National Electric Light Asociation, and application has been made for the formation of a Georgia State Section. The Canadian Electrical Association has appointed a committee to consider the advisability of that body becoming a N. E. L. A. section.

Telephony in Italy.—The Italian Minister for Posts and Telegraphs is reported to have presented a bill for the construction of a number of new telephone lines for intercommunication between various towns and districts in Italy. The bill proposes a total expenditure of $148,000, of which $12,000 is to be devoted to the purchase of apparatus for experimental purposes.

N. E. L. A. Electrical Solicitors' Handbook.—A new and revised edition of the N. E. L. A. "Electrical Solicitors' Handbook" has been issued. Considerable new matter has been added relating to electric vehicles, garage operations, load and diversity factors. The illumination section has been rewritten and enlarged. The book is only available to members of the association. New members receive a copy free, the price to other members being $1.

Telephone Rate Litigation in Los Angeles.—Suits are pending in the Federal courts brought by the Sunset Telephone Company and the Pacific Telephone & Telegraph Company to prevent the city of Los Angeles from enforcing the new telephone rate ordinance. At the request of the city attorney, who points out that it will be necessary for his office to employ high-grade experts to make an investigation of the properties and business of the telephone companies, the City Council has appropriated $15,000 to be used in the legal defence. The cases will come up for hearing about Sept. 1. Both sides will submit affidavits and no oral testimony will be presented.

Public Utility Regulation in Charlotte, N. C.—The first test by the city of its power to "regulate public or quasi-public corporations," under a remodeled charter, has been instituted by petitioners from Elizabeth Heights, a suburb, who ask the executive board of the city to compel the Charlotte Gas & Electric Company to extend its gas mains into the suburb. The petition, together with an order to file an answer within 10 days, has been served on the electric company, and when the answer is in the real contest will begin. Appeal to the State Corporation Commission is allowed either side, following the verdict of the executive board of the city in the matter at issue.

Barclay Printing Telegraph.—The current issue of the British *Post-Office Electrical Engineer's Journal* contains an interesting article by Major W. A. J. O'Meara, giving an account of a recent visit to this country to study American telegraph and telephone practice. An account is included of the Barclay printing telegraph, which, it appears, is now operated in over 65 circuits from 21 cities. The longest line is from New York to Atlanta (740 miles), and the circuits extend to the Pacific Slope, there being lines between San Francisco and Portland and Los Angeles, and one from the latter city to Denver. Major O'Meara states that during a day when he was in New York 1019 messages were sent from New York to Chicago in 8 hours and 37 minutes over one of the duplexed circuits, and 814 messages were received. New York had 25 and Chicago 24 circuits.

Pittsburgh Electric Railway System Criticized.—In a report to the Mayor of Pittsburgh, Mr. Bion J. Arnold severely criticizes the system of the Pittsburgh Railways Company. Mr. Arnold previously made a report on the electric traction system to the Pittsburgh Civic Commission, which led to his engagement by the municipality for this further report. Mr. Arnold's conclusions are that the traction system is grossly over-capitalized, is in poor physical condition and has been incompetently operated, particularly with respect to maintenance and car routing. Fixed charges in rentals and interest are so high that the company has now an annual deficit of over $1,000,000, and cannot under these conditions rehabilitate the property. Mr. Arnold therefore recommends that the city shall take a hand and advises: "Co-operation in the planning, building and operation of the system, publicity of plans and results and a fair division of the burdens and the benefits of operation. One city, one system and adequate service are the objects which should be worked for by all those charged with the responsibility of making decisions."

Annual Outing of Electric Club of Chicago.—The Electric Club of Chicago will hold its annual outing at Ravinia Park on Saturday, Aug. 6. Ravinia Park is a beautiful North Shore pleasure ground, and it is hoped that the outing this year will be as successful as the one given last year at Michigan City, which was greatly enjoyed. A special train will leave the Wells Street station of the Chicago & Northwestern Railroad at 10:15 a. m. There will be various athletic sports and games, both for ladies and gentlemen, and prizes will be given to the winners of all events. Donations from electrical concerns are solicited as prizes, and Mr. George H. Porter, Western Electric Company, 500 South Clinton Street, Chicago, will be pleased to receive gifts of this character. During the afternoon and evening there will be concerts by the Walter Damrosch orchestra, and there will also be dancing in a pavilion. Mr. Porter, who is chairman of the entertainment committee of the club, is in general charge of the arrangements. Other committees are as follows: Finance, R. M. Van Vleet, J. G. Pomeroy; publicity, H. A. Mott, F. S. Hickok; athletics, W. S. Tausig, F. W. Clement; entertainment of ladies, Otis B. Duncan, W. R. Bonham F. T. Wilbur; reception, William Carroll, W. L. Abbott, Robert E. Mitten, F. F. Skeel, James H. Delaney and J. J. Schayer.

Large Electromagnetic Clutch.—What is said to be the largest electromagnetic clutch ever built has been placed in service at the Ormesby iron works of Cochrane & Company, Middlesbrough, England, for connecting a 1000-hp motor to a blowing engine. The clutch is 7.25 ft. in diameter and weighs 12,500 lb.; it is designed for transmitting 1000 hp at 75 r.p.m. The power required to keep the clutch in operation is 2 kw.

The Rowland Telegraph.—A receiver has been appointed by Judge Norris in the Baltimore branch of the United States Circuit Court for the Rowland Telegraphic Company, of Baltimore. The bill of complaint filed shows that the assets of the company represented by office fixtures and factory equipment are $28,171.42 as against liabilities amounting to $418,418.14. Patents and patterns of the apparatus manufactured by the company are placed at $257,631.29, but are stated in the bill of complaint as next to valueless as assets.

Aid by Wireless.—On July 22 effective aid was rendered by wireless telegraphy when the liner *Momus* developed a fire in its hold and was able to communicate the information to its sister ship, the *Comus*, which rescued the passengers and stood by for two days until the fire was under control. Assistance was offered by several vessels that had picked up the wireless signal of distress, but the *Momus* was able to transfer her passengers to the *Comus* and anchor near Cape Canavarel, off the coast of Florida, 335 miles north of Key West, until the fire had been extinguished.

Reforestation.—The U. S. Department of Agriculture, Forest Service, has 24 National Forest Nurseries with an annual productive capacity of over 8,000,000 seedlings. As an indication of the difficulty of the reforestation problem, it may be pointed out that if the output is 8,000,000 seedlings, this quantity falls short of being sufficient to plant 8 sq. miles of denuded land. The expense of attendance during three years in nursery and of transportation would appear to render this method impracticable for planting large areas. Ten tons of seed will be used this year, most of which will be sown where the trees are to stand. On the basis of 60 per cent of loss, the above quantity will seed about 200 sq. miles.

Smokeless Pittsburgh.—Pittsburghers are learning that part of the local "fog" is in reality smoke, and have started a "blue sky" campaign, the agitation being aided by the railroads. The Baltimore & Ohio is suspending for 30 days any fireman who permits his locomotive to emit black smoke within the city limits. The Pennsylvania imposes a 10 days' sentence. The example of the railroads has been followed by several manufacturing plants. After installing smoke preventers in the factories, employers have warned the firemen that needless smoke will cause their suspension. The outcome of the Chicago campaign relating to the use of electricity as a smoke preventive is being watched with much interest by the Pittsburghers.

Electrical Operation of Powerhouse Switch Railway.—The elaborate stipulations made by the committee on local industries of the Chicago City Council in relation to the switch railway to connect the new Northwest generating station of the Commonwealth Edison Company with the Chicago & Northwestern Railroad tracks have already been mentioned in these columns. It is interesting to note, further, that it is made an express provision of the ordinance that the motive power for the operation of cars on the proposed switch railway shall be electricity, except during the period when the generating station is under construction and electrical energy is not available. The switch railway must be elevated, as before noted, and, in addition, the Commonwealth Edison Company must agree not to allow it to be used for any other purpose than for its own requirements. The railway construction must be of substantial and permanent character, with bridges spanning the streets, supported on abutments of stone or concrete masonry, or on rows of iron, steel or reinforced-concrete columns. The ordinance giving the company permission to build and operate this railroad has a life of 20 years.

Block Lighting in Chicago.—The committee on gas, oil and electric light of the City Council of Chicago has recommended for passage an ordinance granting the Inter-Ocean Newspaper Company authority to supply electricity in a certain circumscribed area in the downtown business district by means of underground conduits. The buildings which may be served are those fronting on the south side of Monroe Street, between State Street and Clark Street, and fronting on both sides of Dearborn Street, between Monroe Street and the alley south of it. The ordinance contains a provision, however, that the grantee must remove all of its underground pipes, conduits and connections at any time the commissioner of public works may direct.

Automatic Telephone Exchange for Chicago.—Work on the designing of the new automatic telephone exchange system for the central business district of Chicago is proceeding steadily under the direction of the receivers of the Illinois Tunnel Company. There will be four exchanges, the locations of which are announced. One will be on the third floor of the Chemical Bank Building, at 85 Dearborn Street, where 4200 sq. ft. of floor area has been leased. The second will occupy two floors in the old Chronicle Building at 164 Washington Street and also a part of the basement in the rear, the total amount of area here being about 12,000 sq. ft. The third exchange will be located on the ground floor of the building at 19 Plymouth Place, the floor area being about 5500 sq. ft. The remaining exchange location is in the Brooks Building, on the southeast corner of Jackson Boulevard and Market Street, the area being about 5000 sq. ft.

New Turbine Equipment for Boston Edison Company.—The Edison Electric Illuminating Company of Boston has placed a contract with the General Electric Company for a turbo-alternator of 15,000 kw regular maximum output rating to be installed in the L Street generating station at South Boston. The turbine, which will be delivered for service in May, 1911, will be the largest prime mover in New England. Moreover, it will be one of the largest turbine sets in the country, with the exception of a similar type to be installed by the Commonwealth Edison Company of Chicago at about the same time; the latter machines will be of 20,000-kw rating. The new Boston turbine will occupy a floor area 19 ft. long and 17 ft. wide, and its height from the floor will be 35 ft. 9 in. The buckets of the turbine will be carried on a periphery 14 ft. in diameter and the speed of the machine will be 720 r.p.m., which means a circumferential velocity of 6 miles per minute. The new machine is of the vertical Curtis type, with six stages, and its total weight will be 800,000 lb. The average high-efficiency steam engine if built for this rating would occupy about 10 times the space of the turbo set, the latter requiring only 11,457 cu. ft., or 0.77 cu. ft. per kilowatt. The turbine will be operated on steam superheated 150 deg. at 200 lb. pressure. The Boston Edison Company already has two turbines of 7500-kw rating in operation at its South Boston plant, and three of 12,000-kw rating. There will be a saving in increased weight of about 25,000 lb. in the new machine, in proportion to the size of the existing 12,000-kw units, which weigh 625,000 lb. each. For the new turbine a condensing equipment having 25,000 sq. ft. of cooling surface will be required, compared with 16,000 sq. ft. in the condensers of the 12,000-kw sets. The circulating pump for the 15,000-kw installation will have a capacity of 30,000 gal. per minute, compared with 22,500 gal. per minute on the largest pump the company is at present operating. The alternator will deliver energy at 7000 volts, the frequency being 60 cycles.

BOSTON ELEVATED RAILROAD COMPANY'S NEW TUNNEL.

Use of Electricity in the Construction of the Cambridge Subway.

THE Boston Elevated Railway Company is at present building a double-track subway in the city of Cambridge, Mass., between the Charles River and Harvard Square, to form the major part of a new rapid transit route connecting Cambridge and the other outlying suburbs with the business center of Boston proper. It is expected that when this subway is completed the running time between Harvard Square and Park Street, Boston, will be reduced from 23 to 8 minutes. Trains are to be operated in the subway, which will connect at the Boston end with a tunnel under the West End district and Beacon Hill, the Boston section being under construction by the Boston Transit Commission. Stations are being built underground at Kendall, Central and Harvard Squares, Cambridge, and the engineering work of the subway is being performed under the direction of Mr. George A. Kimball, chief engineer of the Bureau of Elevated and Subway Construction, Boston Elevated Railway Company. The contractor for construction work in the field is the Nawn Contracting Company, Boston.

One of the most interesting features of the construction work is the extent to which electricity is being employed in connection with excavation, pumping, illumination, tunneling and communication. The work has been so carefully planned and systematically carried out that the contractor is at present about nine months ahead of time on the enterprise. A large part of the electrical supply for the work is furnished by the Cambridge Electric Light Company. The service is of an exceedingly desirable character, since it is required 24 hours per day and seven days per week.

The principal centers of electrical distribution in connection with the subway work are at the Boston Elevated Railway Company's storage building, on Dunster Street, near Mount Auburn Street, and at the contractor's machinery plant at the corner of Massachusetts Avenue and Bay Street. The subway structure is being built of reinforced concrete throughout, with the addition of some structural steel work at the stations. The general method of construction is by open cut from the Charles River through Main Street and Massachusetts Avenue to Central Square. Between Central Square and Putnam Square the subway is being tunneled, and west of Putnam Square the open-cut method will be pursued to the terminal yard of the subway near Harvard Square. The uses of electricity in the work include the operation of electric derricks and cable ways for the handling of excavated material and concrete; the operation of electric hoists; air compressors, elevators, pumps, concrete grouting equipment, and concrete mixing. At present construction work is under way throughout nearly the entire length of the subway in Cambridge, with the exception of one section of the tunnel which is being completed by shield and hydraulic jack, and a section west of the incline on the west side of the Charles River. The surface-car service between Boston and Cambridge via Main Street or Massachusetts Avenue has been largely diverted to other thoroughfares.

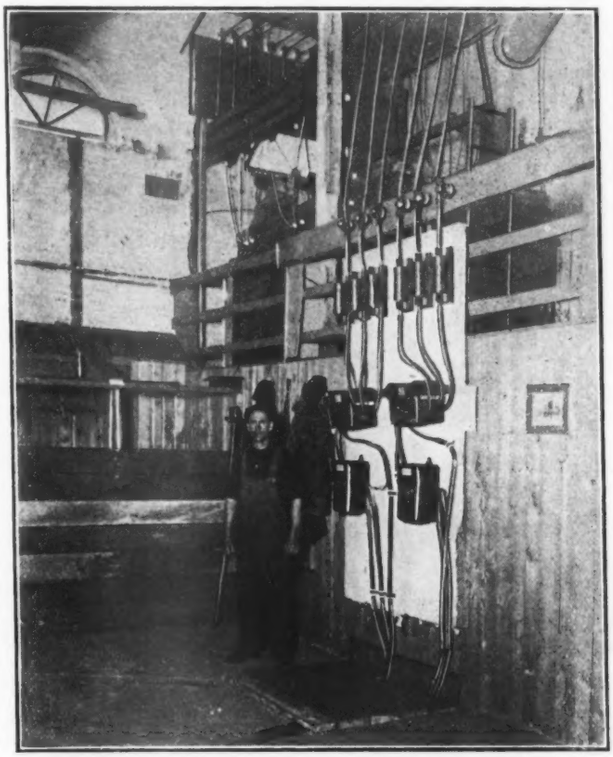


Fig. 2—Transformers and Switchboard in Dunster Street Plant.

Fig. 1 is a view of the interior of the contractor's plant at Dunster Street, which is the principal receiving point for service delivered by the Cambridge Electric Light Company. In this plant are located six 75-kw Westinghouse oil-cooled transformers mounted on a gallery and two 200-hp General Electric induction motors belted to two Ingersoll-Rand "Imperial" type air compressors. The transformers are installed in two banks of three each, and they reduce the potential from 2300 volts to 550 volts for use at the motors. From the transformers leads are brought across the top of the gallery and

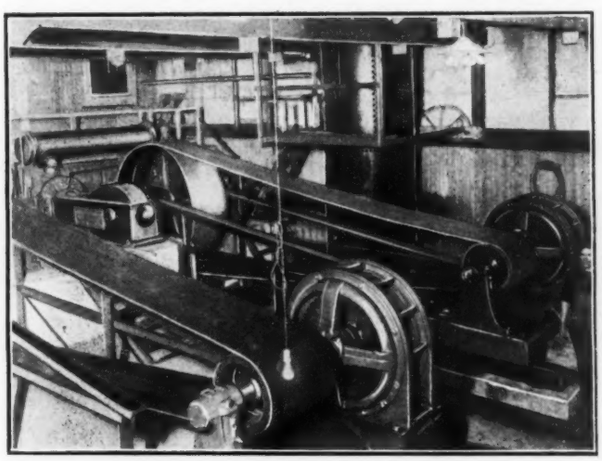


Fig. 1—Electric Air-Compressor Plant, Dunster Street.

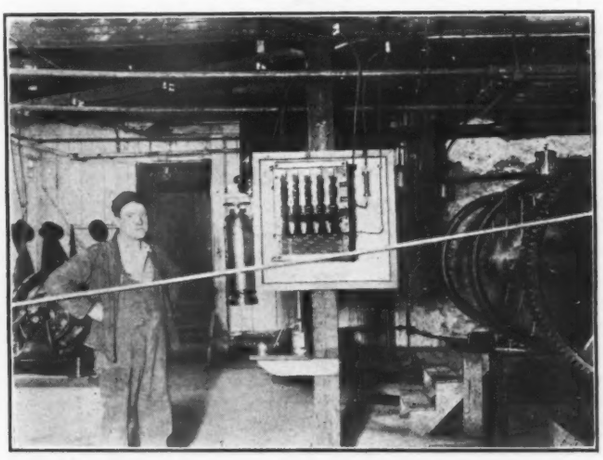


Fig. 3—Electrically Operated Contractor's Plant at Bay Street.

downward to a wooden switchboard, covered with asbestos, on which are mounted two three-phase oil switches controlling the induction motors. The motors are wound for operation at 600 r.p.m. Fig. 2 shows the transformer gallery, motor leads and switchboard, the cables for the motors being carried underneath the floor after leaving the watt-hour meters. Lightning arresters are installed on the primary connections of the transformers where the cables enter the building.

Each motor is belted to a compound horizontal compressor running at 255 r.p.m., and supplying air to a receiver of 1500 cu. ft. capacity at a pressure of from 90 lb. to 120 lb. per square inch. Although the plant is of a temporary character the compressors and motors are mounted on concrete foun-

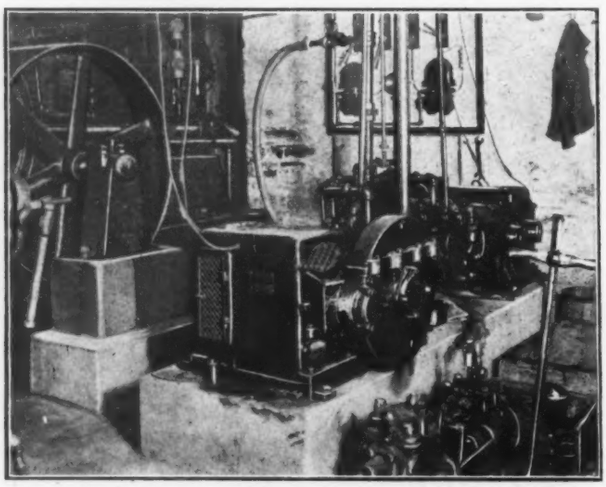


Fig. 4—Electrically Driven Compressor in Bay Street Contractor's Plant.

dations. The motors are started by resistance variations in the rotor circuit. The air-compressor plant is lighted by incandescent lamps supplied with central-station energy through an ordinary lighting transformer. In some cases the compressed-air supply is employed in the operation of hoisting engines of the steam type. The absence of smoke and dirt in the subway construction is noteworthy. The operation of the cableways by air is practically noiseless compared with the usual donkey engine service. A typical cableway operated by air from the electrically driven plant is at work near Harvard Square, the length being 375 ft. It is equipped with a 35-hp air hoisting engine and bucket of 30 cu. ft. capacity, and handles spoil which is brought to the surface through a vertical shaft connecting with the excavations. About one load per minute is handled. Another representative hoist is driven by a 30-hp Westinghouse three-phase, 220-volt induction motor supplied with energy from a transformer located on a pole outside the portable house in which the winding drum is located. An external starting resistance is used in connection with the motor. An electric derrick was used in construction by the so-called "slice" method in Massachusetts Avenue. East of Harvard Square the excavation for the train tracks was performed by cableway. On the entire work the maximum number of electric derricks in operation was five, with three cableways.

A portion of the tunnel in Massachusetts Avenue, between Pleasant and Remington streets, is being built by the tunnel method on account of the greater depth of the subway here and also on account of the heavy surface-car traffic. The roof of the subway is from 10 ft. to 20 ft. below the surface of the street in this section, the inside width being about 26 ft. 10 in. The contractor's plant is located at the corner of Massachusetts Avenue and Bay Street, and it extends southward to Green Street, the latter thoroughfare being about 21 ft. lower than Massachusetts Avenue. The plant includes a yard for the disposal of excavated material, which is conveyed in small cars, holding about 1 cu. yd. each, from an elevator shaft equipped with a steam hoist and an electric hoist. Near the mouth of the shaft is a power plant, shown in Fig. 3. In this plant are installed electrically driven pumps, compressors and small machinery used in repair and emergency construction work. Energy for this surface is supplied mainly by the Boston Elevated Railway Company from one of the direct-current feeder circuits of its surface line system.

The tunnel section of the subway is being built by the shield method. The shield weighs about 70 tons and travels on eight steel rollers on each side wall of the tunnel as the work advances. The shield is propelled by 14 125-ton hydraulic jacks attached to the shell at about equal distances around its circumference, reacting on cast-iron rods imbedded in the arch. The shield moves forward at the rate of about 67 ft. per week, and the hydraulic pressure which operates the jacks is supplied by two duplex, double-acting Watson-Stillman two-stage pumps, each being belt-driven by a 40-hp, 550-volt Holtzer-Cabot motor controlled by a Cutler-Hammer starter. The driving belts are each 8 in. wide, and the pumping plant is provided with a 15-ton accumulator to maintain a steady pressure on the delivery line leading to the shield. The motors run at 900 r.p.m. normally and are of the shunt-wound type. The pumps supply water to the jacks at pressures either of 1500 lb. or 5000 lb. per square inch, according to the demands of the work. The higher pressure is used only when the cutting edges of the shield are unable to force their way through the earth at the lower pressure. The cleanliness, convenience and especially the compactness and low labor cost of operating the electric drive in a limited space of this kind are proving valuable features to the contractor.

The plant also contains two Westinghouse electrically driven automatic air compressors, shown in Fig. 4. These are run at 1100 r.p.m., and have a capacity of 84 cu. ft. per minute each. They supply air at a pressure of 60 lb. per square inch for the ventilation of drifts, and for the operation of a Caniff grout mixer, which forces grout into the space between the outside of the concrete arch of the subway and the surrounding earth

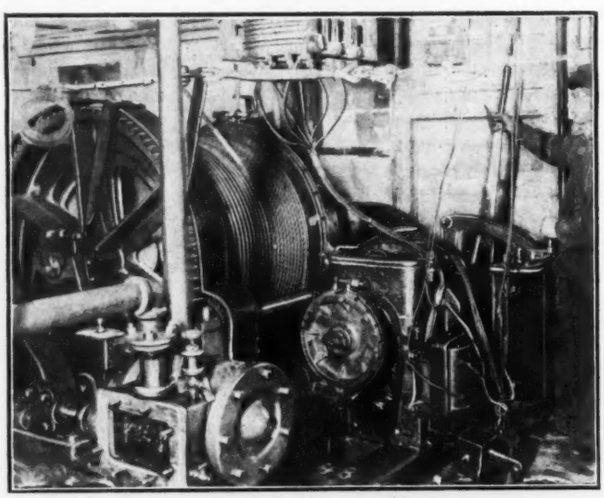


Fig. 5—Electric Hoist at Bay Street Plant.

left by the passage of the shell of the shield. There is a bolt cutter driven by a 5-hp, 550-volt induction motor supplied with energy from the Cambridge Electric Light Company's service, and the blacksmith shop is equipped with a forge blower driven by a 1-hp belted motor.

In the preliminary excavation of the tunnel section when the shaft at Bay Street was built, a sump was excavated in one corner into a stratum of coarse gravel, and a 4-in. centrifugal pump, direct-driven by a 15-hp, 500-volt direct-current motor, was installed in connection with an automatic starter operated by a float. This equipment has kept the premises free from water since its installation, and is in operation but one-third of the time. It possesses marked advantages over the usual method of pumping by Italian laborers. The capacity of the set is 350 gal. per minute.

The floor of the subway at Bay Street is about 45 ft. below the surface of Massachusetts Avenue, and the sump is 10 ft. deep, 10 ft. long and 8 ft. wide. At the Bay Street plant is also an electric hoist driven by a General Electric railway motor, rated at 30 hp, and shown in Fig. 5. The hoist is used in raising excavated materials in cars from the level of the subway floor to tracks located on a wooden platform in the Bay Street yard, from which the contents of the cars are dumped by gravity into teams. Laborers and supplies are also carried into and out of the subway at Bay Street by the hoisting plant. A steam-driven hoist is located beside the electric

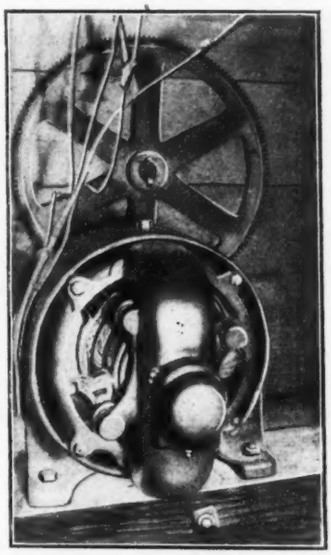


Fig. 6—Motor-Driven Concrete Mixer at Bay Street Plant.

hoist in the Bay Street shaft house, and both are used at times of heavy load. The electric hoist is fitted with a solenoid brake, and its input is measured by a watt-hour meter, so that the contractor can determine the cost of the work more accurately. The railway company's circuit is used to operate the hoist, a simple main switch being installed on the wall to cut energy on and off the controller. The starting resistance is mounted on the ceiling of the shaft house, as shown in Fig. 5.

The concrete for the tunnel section of the subway is pre-

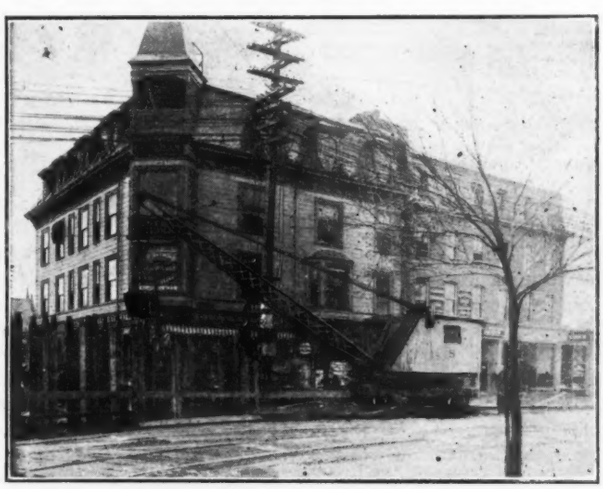


Fig. 7—Radial Jib Hoist, Electrically Operated, Central Square.

pared in a "Municipal" mixer located in a gallery about 20 ft. below the street level. The mixer has a capacity of about ½ cu. yd. and is driven through a gear and pinion by a 10-hp, 500-volt, direct-current shunt motor of General Electric make. A Cutler-Hammer starting box is used in connection with this outfit, and the motor drive is shown in Fig. 6, the motor and gearing being situated on the outside of a bulkhead which separates the mixer from the driving mechanism. The comfort afforded the operator of the mixer by electric drive is a strong point against the usual steam drive, and the motor service proves compact and convenient in the limited space underground where the apparatus is obliged to work.

The contractor has an electrically driven stone-crushing plant of his own in Jamaica Plain, which has a connected motor installation of 175 hp. This includes an air compressor driving drills and other tools, with a 55-hp motor; two stone crushers driven by a 75-hp motor; a 35-hp motor driving a derrick with an 80-ft. boom, and a bull wheel on the derrick driven by a 10-hp motor.

On the open-cut sections of the work east of Bay Street a number of electric hoists are in service, including one of 50 hp driving a 450-ft. cableway; another of the same capacity in an adjacent section of the excavation; a 40-hp hoist, and a radial jib electric hoist, shown in Fig. 7, working near Central Square. This crane is equipped with a 20-hp, 500-volt Westinghouse direct-current motor for hoisting service and a 7.5-hp motor for turning the tower. At the east end of the subway, near the bridge incline on the Cambridge side of the Charles River, a concrete well of the same dimensions as the sump at Bay Street has been built to handle the drainage in the subway east of Kendall Square. This is equipped with a 3-in. centrifugal pump driven by a 15-hp, 550-volt motor and a ventilating fan run by a 1-hp motor. In the residential sections of Cambridge the absence of leaky boilers and hissing steam engines has been much appreciated during the subway construction, and the operators of the electric hoists consider them superior on rough work to steam or air.

ISOLATED INDUSTRIAL GENERATING INSTALLATION.

The Steam Turbo-Generator and Induction-Motor Equipment of Amoskeag Textile Mills.

BY ALBERT L. CLOUGH.

THE Amoskeag Manufacturing Company operates an extensive plant for the manufacture of cotton textiles and worsted goods, which lines both banks of the Merrimack River at Manchester, N. H. About 16,000 operatives are employed and nearly 500 miles of cloth are produced each working day.

Originally, water-power, derived from the Amoskeag Falls, was mainly relied upon, but with the growth of the plant steam power was very extensively introduced so that, at the present time, about 16,500 hp is developed by water and about 21,000 hp by steam. Electric lighting has been in general use in this plant ever since it became practically feasible and electric motors were introduced, upon a comparatively small scale, early in their commercial development and their application has been gradually but consistently extended, until now the generator equipment installed aggregates about 20,000 kw in rating.

Rather recently the mills of several neighboring corporations were acquired by this company, and a very large new textile plant, known as the Coolidge Mill, was constructed. Thus the situation demanded increased electrical generating equipment and led to the erection of the installation described in this article, which has just been placed in regular service.

This power house is of heavy red-brick construction with 24-in. walls and granite foundations. The turbine house is 151 ft. x 67 ft. in size, and the boiler house is 539 ft. long and 45 ft. wide, the turbine and boiler houses forming a letter "L" construction. In the angle of the "L" is located the coal pile, which measures about 120 ft. x 500 ft. on the ground and is capable of containing 16,000 tons. This is surrounded by a line of reinforced concrete posts, grooved for the reception of the heavy plank forming the coal fence. The coal pile extends

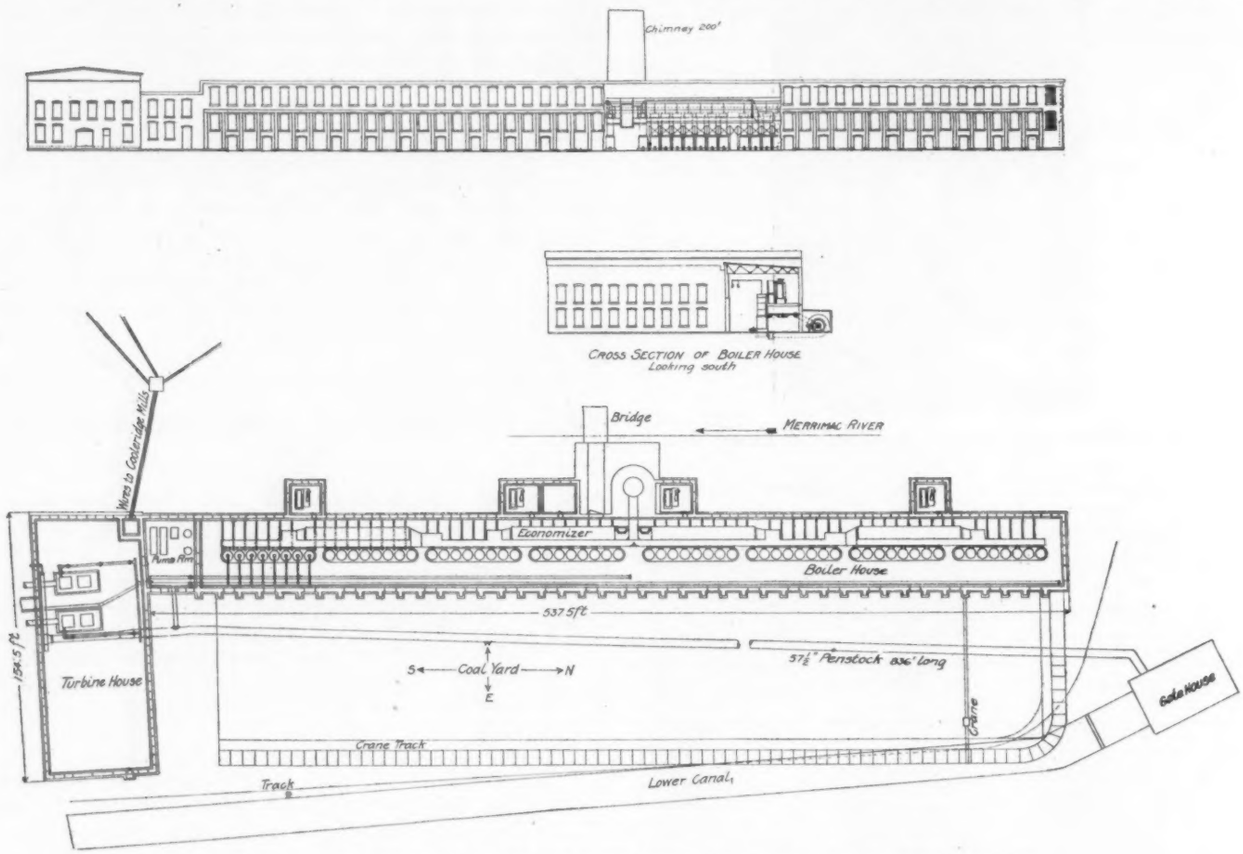
to the railroad siding and the unloading of cars and the distribution of coal in the pile is performed by a Mead & Morrison electric traveling crane, which reaches all parts of the pile.

The turbine house has a basement 10.5 ft. high and the turbine room is 30 ft. high to the steel roof trusses and 22 ft. in clear height to the Niles-Bement traveling crane, an 8-in. pilaster for which is added to the masonry in each bay. Cast-iron columns support the boarded plank floor of the turbine room, which is entirely clear of the turbine foundations. These foundations rest upon the solid ledge and are of very heavy concrete construction.

The boiler equipment consists of 64 Manning vertical boilers, of 150 hp rating, set in a single line nearly 500 ft. in length, with their doors facing the coal pile. Half of these were built by Dillon, of Fitchburg, and the other half in the Amoskeag Manufacturing Company's shops. They are divided into four groups of 16 each. Near the center of the boiler house stands the brick stack, 200 ft. in height, with a 12-ft. flue. There are two horizontal uptake flues, each serving one-half the boilers, these being constructed with ⅛-in. steel shells and 4-in. brick lining and having a 14-ft. x 4-ft. cross-section. The main entrance flue to the stack is 8 ft. x 14 ft. in section. An air duct 3 ft. x 4.5 ft. in cross-section at the blower end and tapered and fitted with manually operated individual dampers is provided under the boiler fronts of each group of 16 boilers. Each duct is fed with air from a Sturtevant blower, directly connected to a simple slide-valve engine, under automatic throttle control, the four blower units being located in small brick additions built upon the rear wall of the boiler house at intervals along its length. The automatic control of each blower is effected by means of a steam-pressure relay which starts the blower engines under low boiler pressure, thus regulating the forced draft independently upon each group of 16 boilers. A Jones underfeed stoker is fitted to each boiler, the rate of action of each stoker of each group being determined by the action of its blower engine through a sprocket geared connection. The exhaust steam from all stoker ram cylinders and all blower engines is piped to the feed-water heaters.

A Sturtevant economizer is applied to each group of 16 boilers, the dampers being so arranged that the chimney gases may be sent directly to the stack in case repairs are necessitated, and feed-water by-pass connections are also fitted. The tubes of the economizers are continuously scraped by means of electric motors acting through worm gearing, one motor serving two economizers.

Two main steam pipes, 20 in. in diameter, with riveted joints and chain supported from the roof trusses, are carried the entire length of the boiler house. One of these branches into two pipes, 12 in. in diameter, to serve the two turbines and the other is at present intended to furnish steam to other parts of the plant. Each boiler is connected to its main through a 4-in. horizontal pipe with a connection swivelling on a vertical axis at the boiler and at the main, to allow for expansion and con-



Sections and Plan of Boiler House and Power Plant, Amoskeag Manufacturing Company.

traction. All boilers are covered with asbestos and banded with Russian iron.

The pumps and feed-water heaters are located in a room between the turbine room and the boiler house proper. The pump equipment consists of a large compound duplex direct acting steam unit and a smaller simple duplex unit. The foundation is also in for another unit identical to that first mentioned. A Reilly tubular feed-water heater takes all the exhaust steam from the auxiliaries and a large open heater is also provided. The piping is so arranged that various combinations can be made in order that the feed water may be by-passed around either heater in case of need. The feed-water supply is obtained from the company's private reservoir.

There is an opening in the boiler-house wall in front of each boiler and the coal pile is always maintained full enough at these points so that coal will fall in upon the floor so close to each feed door that it may be shovelled directly into the stoker hopper. The ash is cleaned from the rear of the boilers to the floor and is removed by dump carts to be used for filling.

The two Curtis turbines which drive the two 3500-kw genera-

tors are of the horizontal type and are said to be of larger size than any of this type that the General Electric Company has heretofore constructed. They are of the five-stage type, with two rows of rotating and one row of stationary buckets per stage. The initial pressure is 180 lb. The bearings are cooled by means of coils of copper tubing embedded in the babbitt, through which water is circulated under gravity head from the company's canal. An oil pressure of 75 lb. is maintained by means of a pump directly driven from the turbine shaft; this pressure is utilized to operate the governor cylinder, the oil passing to the bearings through a manually operated throttling valve which reduces the pressure to about 15 lb. per square inch. Roller-bearing thrust collars resist the axial pressure of the shaft. A direct acting steam pump, mounted upon the turbine base, furnishes the oil pressure required before the turbine starts. The steam is admitted through cam-actuated poppet valves, operated by the governor cylinder through gearing and a horizontal shaft, and the valve action is such that all valves but one are always in either the open or closed position, so that there is throttling at only one valve at any time. The governor is of the centrifugal type, spiral-gear driven from the turbine shaft, and controls the pilot valve which admits oil pressure to one side or the other of the governor cylinder. The emergency safety-stop mechanism consists of a centrifugal governor device carried directly upon the turbine shaft, which, when operated by excess speed, throws out a trigger which releases the throttle valve of the turbine, which in turn closes under the action of unbalanced steam pressure. Each turbine is fitted with a synchronizing device, operated from the switch gallery. This consists of a small direct-current motor, with reversing controller at the switchboard. The motor acts to compress or release a spring in the governor mechanism that is capable of influencing the turbine speed to the extent of 2 per cent, to allow synchronism to be attained. Condensers of the Bulkley type are employed, located just outside of the wall of the turbine station, and the supply of condensing water is derived from a 5-ft. penstock, furnishing gravity head sufficient to maintain the water level at a point about 2 ft. below the heads of the condensers. Priming from the reservoir pressure is required at starting only, after which only the gravity head is used. A vacuum of 28 in. is normally maintained.

The generator equipment consists of two 3500-kw General Electric horizontal-type turbo-generators, having an actual safe output of 4000 kw each. These units are of the six-pole, rotary-field, fan-cooled type and deliver three-phase current at 60 cycles and 2300 volts to a delta-connected system. The rated speed is 1200 r.p.m., with a guaranteed regulation to within 2 per cent from one-half to full-load and the rated output in kva is 4375, with a power-factor of 80 per cent.

There is space in the turbine house for the installation of two other similar units, so that the present rating of 8000 kw can be increased to 16,000 kw.

The exciter equipment consists of three 35-kw direct connected 125-volt direct-current units. Two of these are driven by 2300-volt, three-phase motors, and are located upon the switchboard gallery, while the third is direct connected to a horizontal, single-stage, non-condensing Curtis turbine and is located on the main floor under the gallery. Energy for operating the exciter motors may also be derived from the 2300-volt service of the Manchester Traction, Light & Power Company and from other power stations of the Amoskeag Manufacturing Company. On the switchboard gallery is also located a 75-kw motor-generator unit which furnishes direct current for operating the coal-handling crane.

The switchboard, located upon a steel gallery at the rear of the turbine house, consists of 16 slate panels, of which three are generator panels (one of which is at present blank), three exciter panels, one a panel for the Tirrill voltage regulators, one an incoming line panel for the Manchester Traction, Light & Power Company's service wires, and eight are feeder panels, one of which is now blank. No e.m.f. higher than 125 volts is brought to the board, all switches being of the remote controlled type, and all conductors without exception, in the whole installation are in pipe conduit, with condulet fittings.

The arrangement of this station provides for the operation of all feeders either from the turbo-generators or from the Manchester Traction, Light & Power Company's service wires and thus there are two sets of three buses and all feeder switches are triple-pole, double-throw. The Tirrill regulator is capable of controlling four exciters with one set of contacts to spare. One of the feeder panels is especially equipped to supply energy to the new Coolidge Mill, which is operated entirely by electric motors. The rating of this panel is 4000 kw at 2300 volts. The other feeder panels, which furnish energy to other mills, vary in rating from 475 amp to 750 amp at 2300 volts.

The solenoid-controlled oil switches are enclosed in brick cells, with asbestos wood doors, located upon the main floor under the gallery. Separate cells are provided for the switches in each leg of the generator leads. Each throw of each switch is provided at the board with indicating lamps, red for closed and green for open, and special 125-volt direct-current buses on the back of the board supply energy for the solenoids, which are relay-operated for closing and directly operated for opening, special arcing contacts taking the solenoid discharge.

In the basement, under the switchboard, are located all series and shunt instrument transformers, all conductors being completely inclosed in pipe conduit.

The conductors from the generators to the board are six 1,000,000-circ. mil lead-covered, varnished-cambric cables in Orangeburg fiber conduit embedded in Portland cement, which is carried to a point above high-water mark. From the Coolidge Mill switchboard panel six 1,000,000-circ. mil cables are run up to the power-house wire tower and from these are taken nine 300,000-circ. mil bare hard-drawn stranded cables, which cross the Merrimack River by way of an island on steel towers; four triple-petticoat porcelain insulators are used upon each conductor at each tower. A three-phase lightning arrester of the aluminum-cell type is installed at each end of this line and at the entrance of the Manchester Traction, Light & Power Company's circuit, while over the peak of each tower is run a grounded steel cable for additional protection.

In the entrance at the Coolidge Mill is a solenoid oil switch, controlled from a convenient point upon each of the floors, so that the service can instantly be cut off in case of fire. Distribution in this mill is from three bare vertical buses, carried on porcelain insulators in three deep slots in a vertical concrete duct formed upon the wall of a fireproof tower of the mill. The weight of the buses is supported upon special strain insulators at the top of the tower.

On each floor of the mill is a switchboard from which distribution to that particular floor is effected. In this mill are 126 three-phase, 2300-volt motors, each equipped with its own switchboard, circuit-breaker and instruments. No transformers are used in any part of the system except for lighting upon a small scale and there are practically no fuses employed in the entire installation.

All distribution to motors is through three-conductor, varnished cambric cable tested at 7500 volts and rated at 3000 volts working pressure, enclosed in iron-pipe conduit, so that there are absolutely no exposed wires. The pipe conduits throughout the entire plant are painted an applegreen to prevent their being mistaken for water or steam pipes.

The lighting of the Coolidge Mill is by means of direct-current series enclosed arc lamps operated from Brush multi-circuit generators, direct connected to three-phase induction motors fed with energy from the general supply system of the mill.

The arrangement of the motors for driving the machinery of the various departments of the Coolidge Mill is of considerable interest and would, in itself, furnish material for a special article. Suffice it to say that the varying requirements of the machinery in the various rooms call for special motor provisions, the aim being to secure the desired results with a minimum of lineshafting and with a maximum of all-around economy. All large motors are located in special closed

rooms, with ventilation provided by means of fans. The small motors are mostly supported on the ceiling and reached by special steel galleries.

A very effective system of motor maintenance and inspection is in force, which assures each motor attention at frequent regular intervals, while in case of need an attendant can immediately be summoned to any department by telephone.

GLASGOW ELECTRICALLY-DRIVEN SEWAGE DISPOSAL WORKS.

THE main drainage and sewage disposal works recently completed by the Glasgow (Scotland) Corporation, next to that of the London County Council, is the largest of its kind in the world; the aim of the promoters, the Glasgow Corporation, being the prevention of the discharge of the sewage of the city in the River Clyde. The area at present embraced covers 41½ sq. miles, and includes the whole of the city of Glasgow, with the burghs of Rutherglen, Govan, Pollokshaws, Partick, Renfrew, Clydebank and the intervening portions under the county authorities of Lanarkshire, Renfrewshire and Dumbartonshire. The amount of sewage and proportion of rainfall drained from the area is estimated at 250,000,000 gal. per day. For its collection some 30 miles of new sewers have been constructed, varying in size from 2 ft. 6 in. to 10 ft. in diameter. The stations at Dalmarnock and Kinning Park present nothing of interest to electrical engineers, the pumps being of the steam-driven reciprocating type. The sewage from Govan and Renfrew and district is pumped at the Shieldhall works by three centrifugal pumps, and is given a lift of 21 ft. to bring it to the level of the Glasgow sewage.

The whole works are self-contained—that is, electricity at 250 volts is generated on the spot and everything is electrically driven. Another feature is that there are no belt drives, except for the tools in the mechanics' shop. The lime agitators are three in number, and are for the purpose of keeping the lime mixture in a condition ready to be discharged into the sewage as it enters the catchpit. For this agitating process the mixture passes into three brickwork tanks, each measuring 100 ft. by 30 ft. by 5½ ft. deep. Along each side of each tank there are gantry rails, and on these rails runs backward and forward, automatically reversing at each end, a specially made four-wheeled stirring arrangement, which in traveling keeps the lime liquid in a creamy condition, it being necessary to discharge a saturated solution into the sewage at the catchpit.

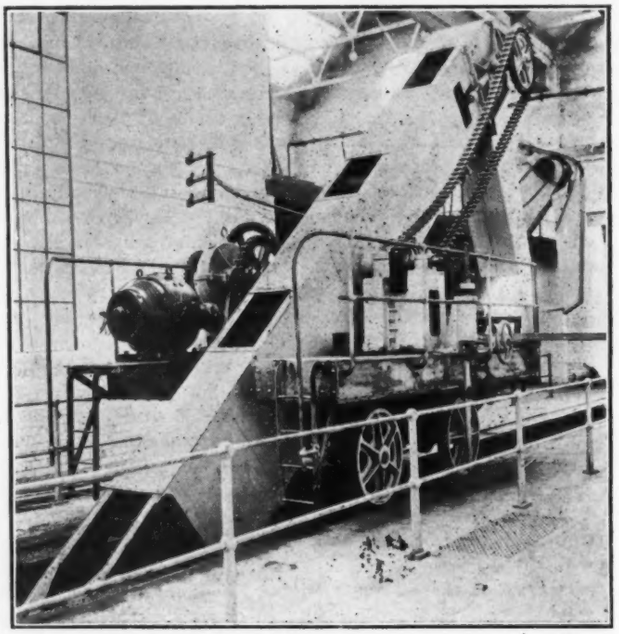


Fig. 2—Catchpit Dredger at Shieldhall.

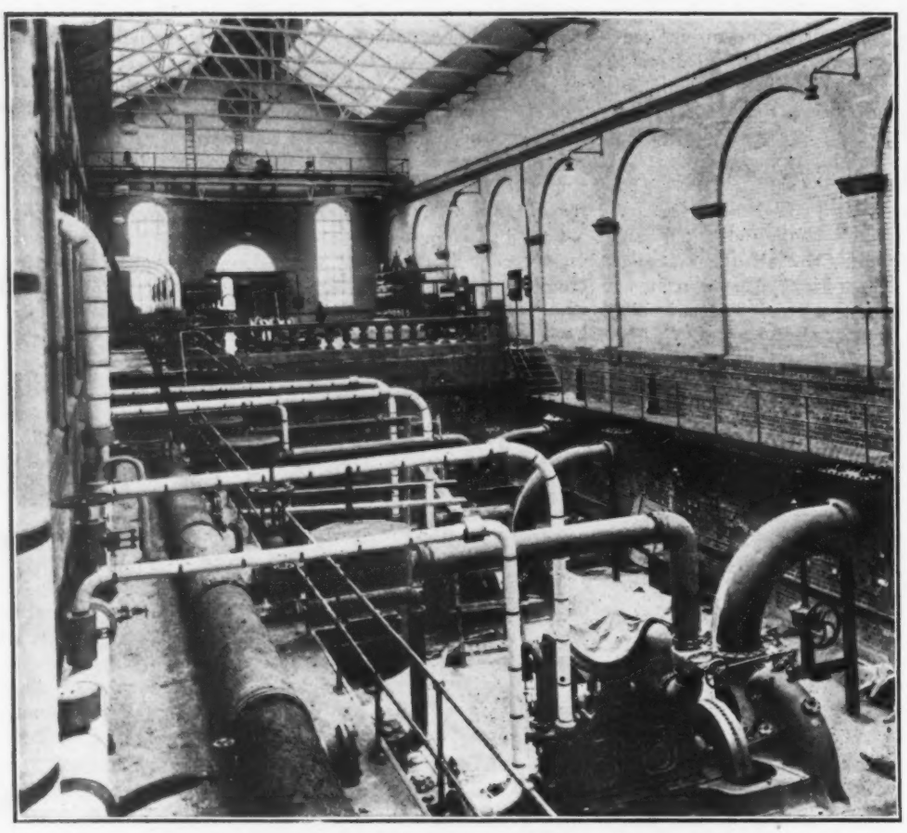


Fig. 1—Main Engine Room, Shieldhall, Glasgow.

These traveling stirrers are driven by endless steel ropes fixed to the screens permanently, but passing over drums which are automatically reversed. These drums, of which there are three to each stirrer, are in turn driven by a 15-hp motor, one motor to each stirrer, through speed-reduction gear and reversing clutches on the drum shaft. The lime mixture is conducted along concrete-lined ducts, and there are suitable penstocks controlled by small motors.

The mechanics' shop has the usual machine tools for repair work and an overhead 8-ton hand-operated traveling crane. There are here two 10-hp and one 5-hp motors. Next to it is the boiler house, containing three Babcock & Wilcox chain-grate mechanically-stoked boilers, and an ash hoist driven by a 30-hp motor on to a line of shafting, and one stand-by feed pump, an economizer, driven by a 5-hp motor, and a large fresh-water storage tank.

Adjacent to the boiler house is the main engine room, as shown in Fig. 1. Here are three Crompton-Howden 150-kw

steam sets generating at 225 volts, the generators being of the shunt-wound direct-current type. The main and feeder distribution switchboards are fitted with double-pole circuit breakers, switches, instruments and fuses, mounted on enameled slate and are of the usual construction. There are also an 8-ton hand-operated overhead traveling crane, two condensers, using the treated solution, by the way, for condensing purposes, and two air pumps.

The pumps for the Govan and Renfrew sewage are also in this room. They are of the centrifugal type, driven by Howden engines. There is one 24-in. diameter for dealing with 600,000 gal. per hour, one 18-in. diameter dealing with 330,000 gal., one 15-in. for 240,000 gal. and two 10-in. diameter. The sewage entering these is controlled through hand-operated penstocks.

The iron liquor tanks are of special construction, being lined with oak, then a section of puddle, and another lining of oak, to prevent leakage and at the same time to withstand the liquor's chemical action. These tanks being built in the ground necessitate the pumping of the liquor into the catchpit. This is effected by a double-ram suction pump driven by a 3-hp motor, direct coupled, situated in the adjoining oxidizer house. In this house are also the three oxidizer drums, as they are termed.

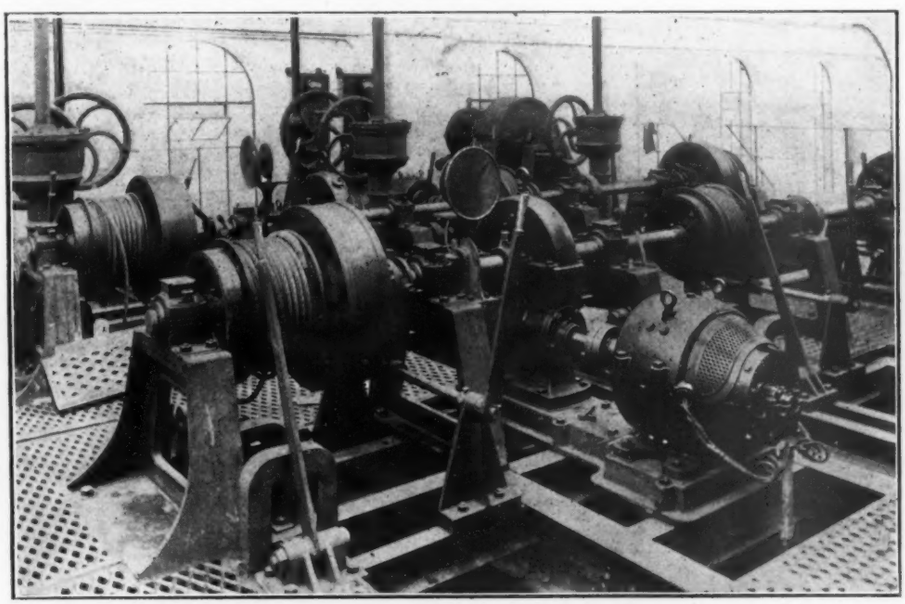


Fig. 3—Screening Plant Motor Equipment at Shieldhall.

The iron liquid, like the lime mixture, must be a saturated solution, and to keep it so and prevent settling or precipitation these revolving drums are necessary. The drums are each 11½ ft. long and 8 ft. diameter, and are constructed entirely of oak. The axles are also of oak and revolve on rollers. The drums are geared to a shaft which in turn is driven by either of two 30-hp motors through a suitable clutch gear. From the drums the liquor gravitates to the catchpit.

Adjoining is the lime store, capable of storing 1000 tons of lime. In this store are also the four pan mixers for slacking the lime and making the mixture. They work in pairs, and are all driven by a 30-hp motor geared to a shaft with clutches for each pair of pan mixers. From here the lime mixture goes to the agitation tanks and back to the catchpit, which is in the house adjoining the lime store.

The catchpit is 170 ft. long, 17 ft. deep and 16 ft. wide, tapering down to a depth of about 18 in. at the bottom. A part of it is seen in Fig. 2. Along each side are standard rails on which runs a unique piece of gear of special construction and the first of its kind. It is to the design of Mr. W. D. Hamilton, the consulting engineer. At Dalmuir a man is required to sit in the traveling carriage, but as this means sitting over the open sewer all the time during a shift, the disadvantage of such an arrangement was obvious, hence this development.

As indicated in the photograph, it consists of a four-wheeled truck carrying a bucket dredger and elevator. The sewage on entering the catchpit meets the lime mixture, which causes the solid matter to precipitate and settle at the bottom of the sloping-sided catchpit. This, therefore, requires constant clearing, obtained by the use of this special dredger. The dredger is self-contained, and after starting requires no attention. It automatically reverses itself at each end of its travel, in moving along the catchpit rails, by means of the kick lever (seen projecting downwards in line with the wheels) striking a buffer fitted at each end of the catchpit. This reverses the clutch-reversing gear on the opposite side of the carriage.

The bucket conveyor at the same time continues elevating the solid matter and empties it through a chute into a truck following up behind. These trucks or wagons are specially made and used for this purpose alone. They are coupled up as usual in railway practice, and move back and forth with the dredger. Being for standard gauge, they are despatched all over the country with the sludge for agricultural use, but the solids obtained are used principally by the corporation on sewage farms. Some of it is used and sold in cakes as fertilizer.

The whole dredger, carriage and elevator is driven by a 30-hp motor fixed on to the carriage as seen. Energy is collected in the usual way through a trolley and three wires. The starter for the motor is fixed to the back of the engine room wall, and the motor is a shunt-wound machine; hence the reason for the three wires seen in the view.

Having dropped most of the solid matter in its passage along the catchpit, the sewage is now attacked by the iron liquor, which enters at the end remote from the lime end. This liquor is made to spray over the sewage by means of a baffle plate. The sewage then passes through a screening plate. These screens are to remove any solids unaffected by the lime, which accumulate at the screens and are removed by a stationary elevator and discharged through a chute into a truck standing below.

These screens are of three different meshes, and can be removed for cleaning purposes periodically like ordinary sluices. For the hoisting of the screens on to the floor level motor equipments are fitted aloft. Each of the grids or screens is fixed to a wire rope, which passes round a revolving drum, which in turn is made to revolve through a friction clutch. The motors driving these are rated at 5 hp and are shunt-wound. The equipment stands on a raised gallery about 15 ft. above the floor level. Speed reduction is obtained through worm and pinion in an oil bath. On this gallery are also the hand wheels operating sluices to close any screen opening when necessary.

After screening, the sewage and treated liquor passes on into the open air, and, by means of suitable brickwork channels, is led into the precipitation tanks of brickwork, 15 in number, and each measuring 400 ft. by 60 ft. wide and normally holding a depth of 8 ft. of treated sewage.

Here it is allowed to rest for a time to allow the iron liquor to purify it, after which it is pumped into two iron sludge tanks, each 115 ft. by 45 ft. by 10 ft. deep. These pumps are three in number, 9 in. diameter and of centrifugal type, each driven by a 20-hp motor. The clear liquor passes off into the river, the sludge passes through pipes 18 in. in diameter to specially built steam hopper barges, by which it is taken out to the open sea and there dropped. The purified liquor discharged into the river can be used for condensing purposes and is otherwise fit for many manufacturing purposes.

ELECTRIC PUMPING IN CALIFORNIA.

By Alton D. Adams.

One hydroelectric system in California has increased its connected motor load from about 1124 hp to 4350 hp in six years, and 86 per cent of this latter power was devoted to pumping for irrigation. Some 1800 acres, devoted mainly to the cultivation of citrus fruits, were irrigated by means of this pumping, so that about 0.21 hp of motor rating was required per acre on an average in the latest year, or 1909.

The pumping was done from wells where the depth of water varied down to more than 80 ft., and the lift of the water above the surface at the wells ranged up to more than 100 ft.

Prior to September, 1909, the generating plants of the electric system had a total rating of 3850 kw, so that this rating amounted to about 0.21 kw per acre irrigated, not counting the other motor and lighting loads. There was, however, a connected lighting load of about 1530 hp at the end of 1909, so that the total stationary motor and lighting load was then 5880 hp, and the 3776 rated hp of the motors devoted to pumping for irrigation represented 64 per cent of this total.

The following figures represent the approximate lighting and motor loads and the total lighting and motor load at the end of each year:

TABLE I.—LIGHTING AND MOTOR LOADS.

End of Year	Lighting Load, hp	Motor Load, hp.	Total Connected hp.	Per cent. Motor Load to Total Load
1903	686	1,124	1,810	62.0
1904	748	1,407	2,155	65.5
1905	810	1,970	2,780	71.0
1906	872	2,372	3,244	72.5
1907	934	3,000	3,934	76.5
1908	1,124	3,593	4,717	76.0
1909	1,530	4,350	5,880	74.0

At the end of 1903 the motor load was 62 per cent of the total, and at the end of 1909 it was 74 per cent. During the period of six years the connected motor load increased about 3126 hp.

The area of about 1050 square miles in which this motor and lighting load is connected lies nearly exclusively in Tulare County, and the largest city served is Visalia, which had a population of 3085 in 1900. Tulare County has an area of 4952 square miles, or nearly five times as great as that served by the electric system, and its population in 1900 was 18,375. In the same year the area of irrigated land in Tulare County was 86,854 acres, or nearly five times the 18,000 acres now irrigated by means of service from the electric system.

The electric lines now include the more populous part of this county and nearly all of its towns, and it may be assumed that the included portion had as much population in 1909 as the entire county in 1900. On this assumption, the total connected load of lamps and motors amounted to 32 hp per 100 people, and the motors used in pumping amounted to 20 hp per 100 people, in 1909. Per square mile of the total area included by the electric lines, the horse-power rating of the pumping motors was 3.6 in the last named year.

Prior to September, 1909, the total generator equipment of 3850 kw at the stations of the electric system was equivalent to 5133 hp, or to 87 per cent of the connected motor and lighting load.

The following table gives the maximum station load for each

TABLE II.—MAXIMUM AND MINIMUM LOADS.

Year	Maximum Load, hp	Minimum Load, hp	Per cent. Min. to Max.
1907	3,310	2,400	72
1908	4,060	2,624	64
1909	4,590	3,155	68

of the years named, the minimum load on the day of the maximum, and the percentage of minimum to the maximum, approximately.

The figures for each year represent a day of 24 hours. In 1907 and 1908 the day of maximum load came in the last third of September, and in 1908 it came on July 29. As a large part of the motors used for pumping operate day and night they must account for the exceptionally high percentages of 64 to 72 for minimum to maximum loads, and the percentages for average loads would, of course, be higher. The maximum loads came between 8 in the morning and noon.

In each case the maximum load was well within the station rating of 5133 hp, and the maximum load of 1909 was 78 per cent of the connected lighting and motor load at the end of that year. The station rating was 87 per cent of this connected load.

During 1907 the average load was 1575 hp on the electric station, or 47.5 per cent of the maximum in that year, and during 1909 the average station load was 2162 hp, or 47.1 per cent of the maximum. As an accident to one of the water-driven generators made it necessary to use steam-power for the first time in 1908, the average load has not been computed for that year.

The figure of 47 per cent for the ratio of average to maximum yearly loads in this electric pumping system is much above the corresponding ratio for electric lighting and motor-service systems in cities, which usually runs from about 25 to 30 per cent. In this electric pumping system the high load factor must be due to the long-hour use of the pumps, which are often kept going day and night during the irrigation season.

The following table contains the average yearly load, the highest average load in any calendar month and the percentage of this yearly to monthly average in each of three years, approximately:

TABLE III.—AVERAGE LOADS.

Year	Average Yearly Load, hp	Highest Average Monthly Load, hp	Per Cent Yearly to Monthly Average
1904	1,013	1,336	78.5
1907	1,575	2,836	55.5
1909	2,162	3,432	63.0

The year 1904 was selected for analysis because it was the last in which the total output was generated by a single hydroelectric plant, the year 1907 was selected because it was the last in which the total output was generated by two hydroelectric plants, and 1909 was selected because it was the latest year. It may be noted that from 1904 to 1909 the average yearly load at the stations more than doubled.

In southern California most of the irrigation is done from April to October inclusive, though some water is used in every month, and the distribution of the demand for pumping has a marked effect on the electric output. Thus in 1909 the total output of the electric system under consideration was about 2864 hp on an average from April to October inclusive, and an average of only about 1166 hp for the months of January, February, March, November and December. The average horse-power of load at the stations in each month of 1909 was as follows, approximately:

TABLE IV.—AVERAGE MONTHLY LOADS.

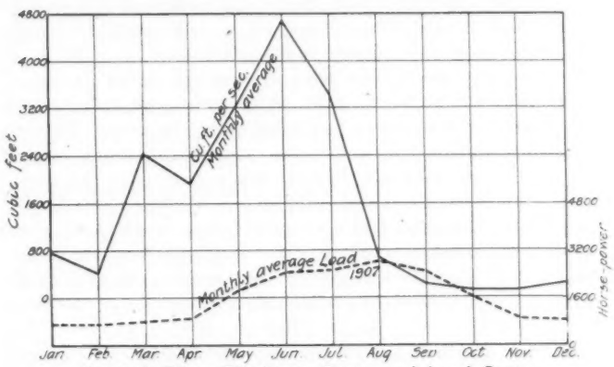
January	1096	July	3432
February	1096	August	3408
March	1120	September	3072
April	1860	October	1908
May	3072	November	1302
June	3288	December	1216

June, July and August were thus the months of greatest average loads in 1909, and this corresponds approximately with the results in other years.

Fortunately for the operation of irrigation pumps by hydroelectric plants the maximum discharge of rivers in the arid regions corresponds nearly in time with the greatest demand for water on the land, so that when pumping must go on at the greatest rate there is the most hydroelectric power to do the work. Such a relation exists in the hydroelectric system under consideration which operated under the above loads with the

water-power of the Kameah River exclusively up to the end of the year 1907. As may be seen from the discharge diagram here presented for the Kameah River in 1906, the latest year that figures are in hand, the greatest mean monthly flow occurred in June and amounted to 4670 cu. ft. per second, carrying away the melted mountain snow. The river began its rise in March and high water continued past the end of July.

For comparison with this curve of river discharge there is also plotted a curve of the average monthly load at the electric stations in 1907, the last year in which all the power was developed by the Kameah River. The two curves illustrate the relation in point of time of the pumping load and the rate of



Kameah River Discharge Curve and Load Curve.

river discharge. It is this relation that makes it possible to operate a hydroelectric plant on a load composed largely of pumps for irrigation with a high load factor.

As noted above, the average load at the single hydroelectric station of this system, in 1904, was about 1013 hp, and that station had a rating of 1350 kw or 1800 hp, so that the station load factor for the year was 56.2 per cent, a figure much above that usually obtained at hydroelectric stations.

In 1905 a second station on the same river brought the equipment rating up to 2850 kw, or 3800 hp, and in 1907 the average load for the two stations was about 1575 hp, so that the station load factor was 41.4 per cent. While this load factor is above the ordinary for hydroelectric plants, more work could probably have been done, for the maximum load on the stations was 3310 hp in 1907.

From the above data it is evident that hydroelectric plants and irrigation pumping are mutually beneficial in the arid and semi-arid States. Without a load of irrigation pumps it appears that most of the great volume of high river discharge in midsummer must be lost to energy production, since there is at that time no other equivalent load to use it. Without hydroelectric plants with their cheap 24-hour service the extent of pumping for irrigation must be more limited.

A large part of the above data has been derived by computation from the diagrams in the paper on "Hydroelectric Power as Applied to Irrigation" in the *Proceedings* of the American Institute of Electrical Engineers, April, 1910, and the remainder has been taken from United States public documents.

SPACE DISTRIBUTION OF MAGNETOMOTIVE FORCE

The Magnetizing Current in the Three-Phase Induction Motor.

By B. B. Brackett.

MANY of the statements of various writers concerning the magnetizing component of the no-load current of polyphase induction motors are either inexact or positively incorrect. Certain other statements are correct, but very hard to understand. One finds it difficult to determine whether total, resultant, equivalent or some other kinds of currents or magnetomotive forces are being discussed. And final conclusions or the formulas given for computing values are in some instances very uncertain and may lead one into errors of application even though the forms are correct for one who can understand them.

A recent edition of a well-known text-book on alternating-current machinery very carefully develops a formula for the magnetizing current in the case of the two-phase motor. Then follow these statements: "In a three-phase machine, at the instant when the magnetizing current in one winding is at maximum value ($\sqrt{2}I_{mag}$), the magnetizing current in each of the other two windings is at half maximum value $\left(\frac{\sqrt{2}}{2} I_{mag}\right)$, and hence the current which sets up the m.m.f. is $\sqrt{2}I_{mag} + 2\left(\frac{\sqrt{2}}{2} I_{mag}\right) = 2\sqrt{2}\,I_{mag}$, ... the magnetizing current per phase for the three-phase induction motor is found to be one-half that for the two-phase motor, or half that given by equation (5)."

The first statement is perfectly correct, at least as far as it refers to the currents at the time and their sum at the instant, but the last statement supposed to be derived from the former one is quite incorrect. The reasoning employed overlooks the relative positions of the coils on the stator. The conclusion would be correct if the coils of all the phases were placed exactly over each other, and not in the partially overlapping positions required for the production of rotating fluxes. The pole pitch and the width of the flux around the air-gap under all conditions are fixed by the coils of any one phase, and this peripheral distance cannot be widened to include an extra two-thirds of this space, as would be involved in assuming that all the flux of the two groups of coils carrying the one-half maximum current unites directly with the flux from the coils having the maximum current in them. If one phase winding is used alone the pole pitch is exactly the same width as when all phase windings are used at the same time in polyphase operation. One phase winding only with the rotor stationary produces a simple alternating flux, similar to that of the familiar stationary transformer. Two or more phase windings supplied with polyphase currents produce a resultant rotating flux that is more or less constant in value and in distribution over the now moving pole face, the total value of this moving flux being at all times approximately equal to the maximum value of the alternating single-phase flux. The exact way in which these fluxes unite into one is often overlooked, or is treated in an abstract way that can not be readily identified with the actual phenomena involved.

In the three-phase motor each winding may be considered to produce its own flux just as if the two other windings were not present. The other two fluxes may be considered as being displaced one-third of a pole pitch, one to one side and the other to the opposite side from the first flux. This difference in position may be called a 60-deg. displacement, if desired.

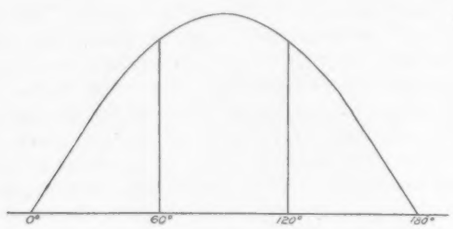
One thing more needs to be observed and remembered. Where the flux for one pole for one winding ceases it immediately reverses its direction. Hence, the flux in one pole space will in general be the resultant of the flux produced by the windings of one phase for one pole and the flux from two other similar windings, overlapping two-thirds of the width of each, but usually contributing more than two-thirds their value at the time, due to the distribution of each flux in its own zone, while this must be reduced by two other fluxes that overlap one-third of a pole space, and in general represent less than one-third the flux per pole in those windings at the instant.

To refer to the coils themselves or to their magnetomotive forces, it may be said that the flux from one pole, in the pole space to which it must be confined, is produced, at the time considered in the quotation above, by the full maximum current in the coils belonging to one phase and the half maximum value in two other windings, each of which overlaps two-thirds the entire width of a pole winding in such a way as to aid the first coils, and also overlaps one-third of a pole space with current flowing in a direction to oppose the flux. To assume that each of the two last windings contribute to the flux per

pole in proportion to their currents is not only to overlook the fact that they do not lie entirely within a pole space, but also to neglect counteracting effects of a part of two corresponding groups of coils. Any diagram of a typical three-phase winding will make these relations clear, if the above is not in itself sufficient.

It is quite as much an error to overlook the relative space displacement of the coils of the different phases as it is to neglect the time-phase displacement and take the arithmetical sum of quantities that should be considered as vectors and combined vectorially into a resultant value. In fact, in this case it is really the same thing, for the correct results may be reached by treating either the component fluxes or the magnetomotive forces as vectors. But to consider the overlapping effects of the various windings will keep one's thoughts nearer what actually occurs than would the more abstract vector method; and this coil-position method may be applied correctly to any known distribution of the flux over the pole space.

It is well to consider more completely the effects in the case of a sine wave, or ideal distribution of the flux. From the properties of the sine curve, shown in the accompanying



Space and Time-Phase Magnetizing Relations.

figure, it may be seen that one-fourth of the area of the curve lies between the 0-deg. and the 60-deg. ordinates, or between 120 deg. and 180 deg. Either of these represent the outside one-third of the overlapping pole spaces discussed above. Likewise, between 0 deg. and 120 deg. will be found three-fourths of the area, representing the value of the two-thirds overlap that is mentioned above. These values may be determined by simple integration, or from any carefully plotted sine curve by means of the planimeter.

Now if Φ represents the flux produced by the maximum current in one of the phase windings, one may consider that at the same time the half maximum currents in the two other windings have established fluxes of $\Phi/2$. Of this $\Phi/2$ flux, one-fourth, or $\Phi/8$, lies in each of the outer one-third of the flux zones; and three-fourths of $\Phi/2$, or $3\Phi/8$, in each of the two-thirds of a pole space. The resultant flux for a complete pole space will therefore be $\Phi + 2(3\Phi/8) - 2(\Phi/8) = (3/2)\Phi$, or the two-third space overlap in a contributing direction and the one-third space overlap in an opposing sense, for both the second and the third phase windings have increased the flux exactly 50 per cent over the maximum that the same current now in each winding of the three would produce in any one of the three alone. To get any desired flux under these conditions there must be supplied to each of the three phase windings two-thirds enough current to produce the same flux in any one of the windings alone.

The method here suggested may be readily used to study the effects of flat or peaked wave distribution over the pole space. If the wave is more or less flat topped, the outside one-third of the flux space will naturally contain a relatively greater portion of the total flux; and, hence, the reducing effect of the second and third phase windings will be increased. A study of the actual wave of distribution will tell how much. Should the distribution of the flux be uniform over the whole pole space, the portion of the fluxes to be added and subtracted would be the same as the space overlap of the various coils. Then the total or resultant flux, under the conditions discussed above, would be $\Phi + 2\left(\frac{2}{3}\frac{\Phi}{2}\right) - 2\left(\frac{1}{3}\frac{\Phi}{2}\right) = 1\frac{1}{3}\Phi$. Here the two other phase windings add only 33 per cent to what one phase winding alone would produce. Hence, to produce any definite flux would require three-fourths the current in each phase winding that would alone give the flux in any one of the windings.

In most standard motors the flux distribution is somewhat flatter than that represented by the sine wave, and the magnetizing current is a shade larger than two-thirds, or 60 per cent, of the single-phase value. This will usually appear in the analysis of the relative no-load currents and power-factors of a motor when tested for both three-phase and single-phase operation. Theoretically the wattless component of the current in the leads not opened, when the change to single-phase is made, should decrease slightly less than is usually observed to be the case. The change that may be noted for most motors indicates a greater relative magnetizing efficacy for a current in one phase only than would exist if the coils could be so placed that those of one phase would give a flux with sine distribution.

If the distribution could be more concentrated at the center, or more peaked, than that corresponding to the sine wave, opposite results might be detected.

These differences are usually smaller than could be predetermined with any accuracy whatever in the design of a motor not yet constructed, but the completed motor may show the peculiarities of its flux distribution and the relation of this to the sine wave distribution. The whole method may be used to verify and to emphasize the correct relation between the current in each phase winding of the three-phase motor and the flux produced by the three currents in three-phase relations.

Central Station

Management, Policies and Commercial Methods

DENVER ELECTRIC SHOW.

Denver will have its first electric show at the Auditorium in that city beginning on Saturday evening, Oct. 8, and closing a week later, on the evening of Oct. 15. The members of the Colorado Electric Club have organized the Colorado Electric Club Exposition Company, capitalized at $10,000, the shares of which were all subscribed at the time the organization was effected. This company will give the show. The main floor of the Auditorium and also a portion of the basement will be divided into exhibit spaces which will be sold to exhibitors at a fixed schedule of prices, varying according to the size and desirability of the space. All of the flooring will be covered with a green carpet and the aisles will be 10 ft. wide. Admission will be charged to the show, the price of tickets being 50 cents for the evening and 25 cents in the afternoon. Music of a high grade will be provided, and an especial effort will be made to provide attractive and spectacular lighting features.

The approach to the Auditorium from Eighteenth Street on both Champa and Curtis Streets will be emphasized by illuminated archways extending over three blocks and made by stretching rope cables with a portière effect across the streets. Franklin's kite will be reproduced on a large scale in electric light and an electrically illuminated bell 40 ft. in diameter will also be an attraction. Inside the building the principal lighting feature will be a Pike's Peak sunrise effect. The various tints preceding and blending in the ruddy glow on Pike's Peak on a fine morning will be faithfully reproduced by electricity.

The club has set aside $500 for various prizes and awards, as well as $300 in scholarships in recognized educational insti-

tutions as prizes for the most original electric devices exhibited by pupils of the graded schools or high schools. There will be a first prize and a second prize for the best arranged and most attractive display, as well as a first and second prize for the best exhibits shown in action. There will also be a first and second prize for skill displayed in arranging exhibits not in motion.

The price of a space will include posts and railings; also ample light for all ordinary purposes; also wiring outlets for all spaces on the main floor and in the basement for additional electrical energy. The price further includes one sign for each space, floral decorations, one table and two chairs, and watchman service. On the main floor 110-volt or 220-volt, single-phase, 60-cycle alternating current will be supplied to the amount of 1300 watts to each exhibit space. Direct current at 220 volts or 440 volts is also obtainable. All electrical energy used by the exhibitor, except that supplied for general illumination, will be furnished at his expense.

The officers and directors of the Colorado Electric Club Exposition Company are as follows: President, H. L. Woolfenden (Allis-Chalmers); first vice-president, F. W. Frueauff (Denver Gas & Electric); second vice-president, J. B. Griffith (Nernst Lamp); secretary and treasurer, C. F. Oehlmann (Denver Gas & Electric); directors: Alvin R. Hall (Capitol Electric), George A. Woolley (General Electric), W. J. Matthews (Denver City Tramway), Walter F. Brown (Colorado Telephone), W. P. Carstarphen, Jr. (Carstarphen Electric), John M. Connelly (Denver Gas & Electric), B. S. Manuel (Westinghouse Electric & Manufacturing).

The officers and directors are chairmen of committees as follows: Admissions, Mr. Brown; decorations, Mr. Griffith; entertainment, Mr. Manuel; lighting, Mr. Oehlmann; novelties, Mr. Carstarphen; prizes and awards, Mr. Hall; publicity, Mr. Connelly; sale of space, Mr. Woolley; transportation, Mr. Matthews.

AUTO TRUCK TO ADVERTISE RESIDENCE LIGHTING.

About 12 of the outlying local business centers of Chicago have their streets rendered especially bright and attractive by special tungsten-pillar illumination, the expense of erecting and operating which is borne by the merchants benefited. Besides these there are many other local-improvement associations in the city whose expressed purpose is to render their own particular communities more attractive for residence and business, and who are also potential users of some similar special street lighting.

As these new tungsten installations are opened up, from time to time, the Commonwealth Edison Company, which furnishes the energy for all this special lighting, usually joins with the local merchants in holding a parade in the newly lighted district. For this purpose it has equipped one of its 5-ton electric delivery trucks with a small electrically lighted model of a dwelling which advertises its house-wiring proposition. The house is outlined in small tungsten lamps and there are also signs carrying the name of the company, all supplied with energy from the vehicle battery. The truck is usually accompanied by a number of young women from the company's offices who ride inside the house, and the parades are generally the occasions of the greatest merriment for everybody. The merchants in the neighborhood are pleased at this attention of the company, and the advertisement for electric service in dwellings is presented at a time when the advantages of electric lighting are obvious to the community which centers about the brightly lighted area.

Auto Truck for Advertising Residence Lighting.

CENTRAL-STATION STREET CAR ADVERTISEMENT.

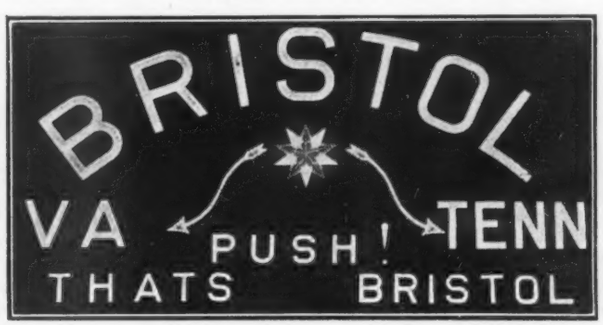
The street-car advertising design shown in the accompanying illustration is now being used in Brooklyn, where it has attracted considerable attention for its clever adaptation of the Roosevelt "de-light-ed." This car card is the result of a system of suggestions which the Edison Electric Illuminating Company, of Brooklyn, has in force, whereby prizes are awarded monthly to those offering the most useful ideas and improvements in method. The "be-light-ed" idea was supplied by the purchasing agent to a district clerk, who is also more or less of an artist. The card is, therefore, altogether a home product.

Brooklyn Street Car Advertisement.

"SLOGAN" SIGN.

The accompanying illustration shows a "Slogan" sign presented to the city of Bristol, Tenn.-Va., by Henry L. Doherty & Company. The sign is 30 ft. high by 60 ft. long, contains 700 white, 100 red and 100 green lamps, or a total of 900 lamps. The word "Bristol" remains stationary, and the star scintillates. The arrows flash immediately before the appearance of the words "Va.-Tenn.," the word "push" then spells itself and "That's Bristol" follows.

The sign, which was erected at a cost of $1,200, was designed by Mr. Geo. Williams, of Henry L. Doherty & Company, New York, and will be maintained in lamp renewals and energy by the Bristol Gas & Electric Company. It was presented on the night of July 4, the Mayors of the twin cities accepting and turning on the light.



"Slogan" Sign in Bristol, Tenn.

The sign is most advantageously located, facing the railroad, that it may be seen by every one passing through Bristol and for miles around the surrounding country. The largest crowd ever seen in Bristol witnessed the lighting of the sign.

SALE OF ELECTRICAL ENERGY BY THE CENTRAL COLORADO POWER COMPANY.

Articles have appeared in these columns from time to time describing the system of the Central Colorado Power Company, which owns water-power plants in Colorado with a present rating of 20,000 kw and transmits energy over 100,000-volt transmission lines for supply at Leadville, Denver and several mining camps. This company sells energy at wholesale to the Denver Gas & Electric Company, and supplies central-station service to the central-station company which it controls at Leadville. It also sells at wholesale to the United Hydro-electric Company in the Clear Creek district through a sub-station at Idaho Springs.

In the Boulder mining district and in the mines around Dillon, the company sells directly to the consumer at retail. It is the purpose of the present article to discuss especially the rates and methods of charging for the retail service. For this there is reproduced herewith a very handy chart which the company keeps in pocket blue-print form for the use of its representatives when talking motor-service contracts. This

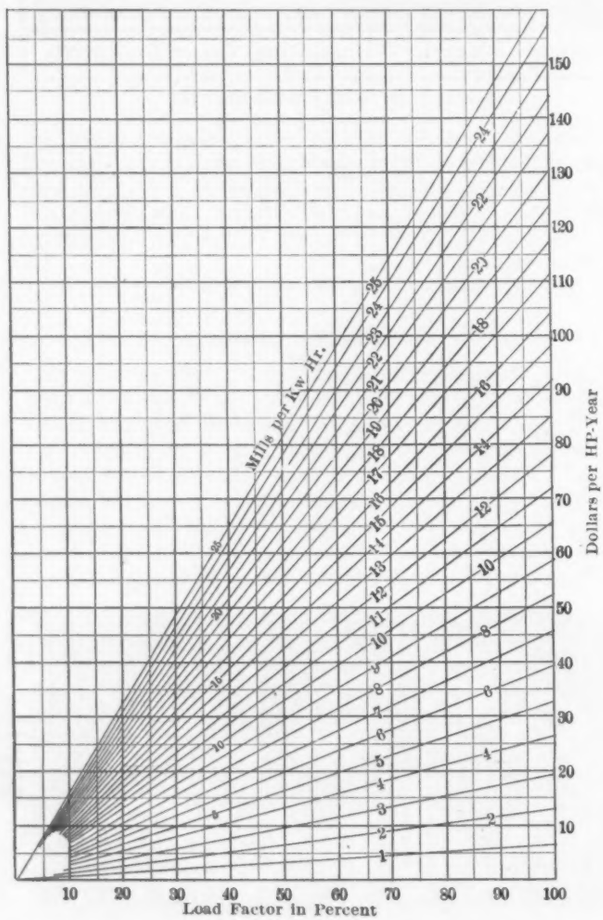


Fig. 1—Chart of Load Factors and Costs at Various Rates.

chart, Fig. 1, indicates the dollars per hp-year, which are the equivalent of various rates per kw-hour at various yearly load factors, the load factor in this case being the standard A. I. E. E. definition of the ratio of the average load for the year to the maximum load of the year.

The standard rates of this company are based on a fixed service charge, which is as follows: The first 100 hp, $39 per year per horse-power; the next 400 hp, $27 per year per horse-power; the next 500 hp, $21 per year per horse-power; all over 1000 hp at $12 per year per horse-power. The foregoing is for the fixed or readiness-to-serve portion of the rate. In addition to the fixed portion there is an energy charge of 1.3 cents

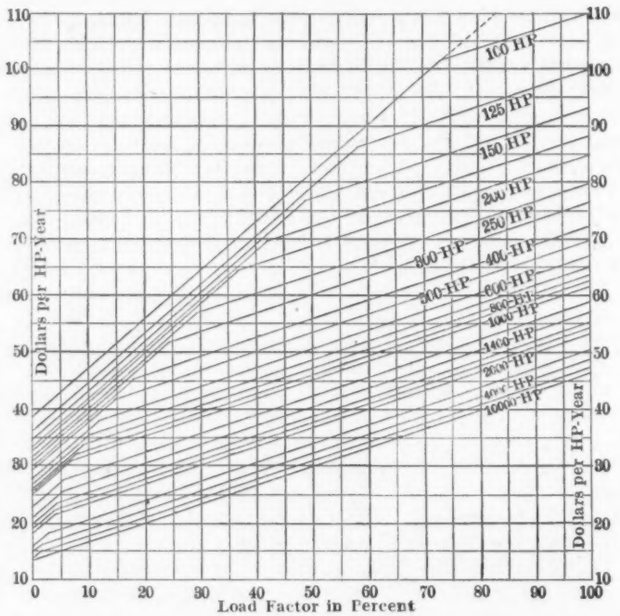


Fig. 2—Chart of Costs for Various Maximum Loads.

per kw-hour for the first 40,000 kw-hours and 0.5 cent per kw-hour for the remainder.

In Fig. 2 is given a chart prepared by the company to show the rate per kw-hour which would be obtained under this system of rates at various load factors with various connected loads. To use the chart one should follow the vertical line corresponding to the load factor of the particular load under consideration up to the curve corresponding to the maximum demand in horse-power of the load, and at the point of intersection with the horse-power curve the horizontal line will correspond to the dollars per year per maximum horse-power.

The following is an abstract of the company's forms, or standard motor-service contracts, which may be of value to other companies drawing up such contracts:

The company agrees to supply the user electric power at a potential of approximately ..... volts, not exceeding ..... electrical horse-power at any one time, to be used only for operating ..... at the users property known as ..... at or near ..... Colorado, and for lighting said property, which the user agrees to pay for at the following rate each month, to be paid before the ..... day of the succeeding month.

A fixed charge per month per horse-power of maximum demand as follows: For the first 100 hp, $3.25; for the next 400 hp, $2.25; for the next 500 hp, $1.75; for all additional horse-power, $1. Add for all energy used, as shown by meter, 1.3 mills per kw-hour for the first 40,000 kw-hours used each month and 0.5 mills per kw-hour for all additional energy.

The day for commencement of service is then named. The maximum demand is determined by the company by meters, disregarding starting peaks and those due to short-circuit or accident to user's apparatus. The user agrees to pay fixed charges upon not less than a specified horse-power whether any energy is used or not. A blank is then left for any special stipulations or requirements. The user agrees to pay a definite sum to the company, which is an advance on the cost of the pole line, this sum being repaid to the user by the rebate of a certain named per cent of the monthly motor-service bill. The company agrees to supply and the user agrees to take from the company all electrical energy required by the user during the

contract, provided the company has such energy free for disposal.

Certain rules and regulations of the company are made a part of the agreement. The agreement must continue in force for a term of years named from the commencement of service and thereafter until the expiration of six months' written notice by one of the parties to the other of its intention to terminate the contract. If after a named period of months after commencement of service, the user permanently abandons operation of the property named in the contract, the company will remit its charges under the contract, beginning a named number of months after receipt of written request. If the user thereafter resumes operation on his property, the agreement is to be in full force and effect for the remainder of the term of the contract, not deducting the period of suspension of operation. The agreement is to bind and benefit the successors and assigns of the respective parties, but neither the user nor his assigns shall assign any right under this contract without the written consent of the company.

The user is to make or procure rights-of-way for the company's lines across the property owned or controlled by the user, and shall furnish a building of size, type and location satisfactory to the company for transformers, meters and other appa-

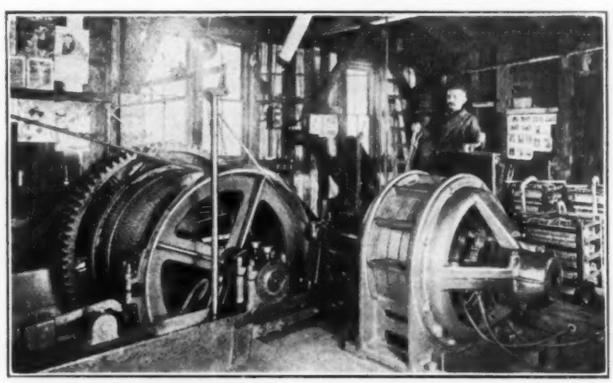


Fig. 3—Typical Mine Hoist Installation.

ratus. The company shall deliver energy at the building in the form of three-phase alternating current of approximately 60 cycles. The user must advance to the company the cost of all lines in excess of 500 ft. in length from the company's established distributing circuit, and must furnish all apparatus, appliances and circuits required for utilizing the service beyond the points where the company delivers the energy. All apparatus and material supplied by the company remain its property and are to be returned by the user in the condition received, ordinary wear and tear excepted. All the user's apparatus must have the highest practicable power-factor and be suitable for operation with the electricity supplied by the company. The user must keep his installation in good condition, and must not make any changes without the written consent of the company. The company may examine the user's installation at any time and may refuse to commence or continue service unless it is satisfactory. Suitable meters are supplied by the company to be connected at or near the point where energy is delivered. The user may install meters at his own expense for checking the company's measurement. In case of dispute as to the accuracy of the company's meters they are to be calibrated, and if found inaccurate proper allowance must be made, but not for more than 30 days prior to calibration. When the company's meters fail to register, it adjusts its charge on the basis of energy registered during a reasonable period of operation under similar conditions.

The company may at any time examine, change or repair its property on the premises of the user. The user must not interfere with or alter the company's meters or other property or permit the same to be done. The user must indemnify the company for all demands and expenses for injury or damage to persons or property in or about the property of the user. The company may suspend service for inspection, alterations or repairs for not exceeding 12 hours every two weeks upon giving the user notice. For every other or longer interruption of service, special provisions are made. The damages for interruption of service are to be 1.5 times the fixed charges under the contract. Upon violation by the user of any obligations of the contract, the company may suspend the supply of energy until the user shall cease such violation.

For mine hoisting a different schedule of rates prevails, known as the hoist rates. The rate quoted for this service is the standard rate. Fig. 3 shows a typical mine hoist installation on this company's lines.

Wiring and Illumination

IMPROVED LIGHTING IN RACINE, WIS.

Merchants and property owners in the block on the main street, between Fourth and Fifth streets, in Racine, Wis., have agreed to pay part of the cost of special column lamp posts on that street. The electric light company is installing several side lamps on Wisconsin Street as an experiment, and if they prove to be satisfactory it is stated that the city will enter into a contract with the company for a number of them to take the place of the overhead lamps. On the completion of the duct work property owners will be required to pay the cost of making connections with the underground mains, as they do now with sewer, water and gas services.

SPECIAL STREET LIGHTING FROM BRACKET LAMPS ON BUILDINGS.

A departure from the standard pillar arrangement of special street lighting which has recently obtained such a vogue throughout the country makes use of the lamps on ornamental brackets supported from the adjacent buildings. An experimental block of this construction has been installed on East Sixty-third Street, Chicago, a South Side business thoroughfare. The immediate reason for the unusual arrangement in this instance was the presence of the elevated-railroad supports along the curb line, which would detract from the effect of the vertical posts. The lamps installed will be three-glower Nernst units rated at 300 cp on 220 volts. Twenty of these lamps will be used to the block, 10 being installed on each side of the street at approximately 40-ft. distances. The lamps will be suspended from brackets, utilizing the characteristic downward distribution of this type of illuminant to the best advantage in lighting the sidewalk. The brackets support the lamps at a point about 12 ft. above the sidewalk and 5 ft. out from the building line. The installation has been put in on a 30-day trial agreement, and if successful this arrangement of lamps will be extended along other blocks on Sixty-third Street.

ORNAMENTAL POST LIGHTING AT FT. DODGE, IOWA.

The business men of Ft. Dodge along with other public-spirited citizens have entered into a contract with the Downing Electrical Co. of Ft. Dodge for a system of lighting the business district with the Corinthian Standard of the Flour City Ornamental Iron Works of Minneapolis. The longer blocks will have four standards on a side and the shorter blocks, three on a side. There will be about 70 poles installed, each equipped with five 100-watt tungsten lamps. The conduits will be run from post to post along the curb line under the creosote block paving, the curb stone being drilled to al-

low the conduit to enter under the post which will be located on the walk adjoining the curb.

The expense of installing the lamps is borne principally by the merchants and the owners of the property. The estimated cost per front foot is $1.75, four-sevenths of which will be paid by the owner and three-sevenths by the tenant.

The Ft. Dodge Light & Power Co. has agreed to light all posts, make necessary renewal of globes and lamps, and paint the posts once a year, at the flat rate of $7.00 per post per month. All five lamps on each post to burn till 11 p. m., and the top light all night.

The principal business street of Ft. Dodge is beautifully adapted for the boulevard system of lighting by reason of its gradual slope from one end to the other. The adoption of this special lighting is due to the enterprise of the Commercial Club in securing sufficient subscriptions to "boost Ft. Dodge" electrically.

SPECIAL TUNGSTEN STREET ILLUMINATION IN LANSING, MICH.

The enclosed-carbon street arcs on the principal sections of Michigan and Washington avenues, at Lansing, Mich., are being replaced by multiple tungsten lighting, both fixtures and energy supply to be furnished by the city. The tungsten pillars, which were made by a local firm, are 14 ft. high, 11 ft. of which is made up of a single casting in which the final wrought-iron pipe is inserted. This upper pipe ends in a ball fixture from which the cross-arms and top lamp are supported. The corner fixtures carry five 100-watt lamps, and the intermediate pillars three 100-watt lamps. These are wired on two circuits, so arranged that the side lamps may be extinguished at midnight, while the top lamps burn all night. Three-wire, lead-covered cable wrapped in steel tape has been used in the conduits.

The iron lamp standards are installed four to the block on each side of the street, at about 66-ft. intervals, giving one fixture for every three store fronts. About 180 will be erected in the first lot to be installed, lighting the principal blocks of Washington Avenue and the Michigan Avenue approach to the State capitol. Later the illumination will be extended to the side streets, adding 100 more fixtures. The standards complete with lamps and globes have cost $45 each, exclusive of wiring and conduit. The expense of installing has been met from the surplus fund of the city electric light plant, which furnishes the bulk of the local commercial and domestic lighting, having about 3000 customers. The energy supply for this special tungsten illumination will also be furnished by the city plant as part of the regular street-lighting system. Mr. Frank Baker is city electrician of Lansing.

FUSING OF BRANCH CIRCUITS OF LOW-VOLTAGE LAMPS.

Since the advent of the 5-cp, 10-volt tungsten sign lamp many inquiries have been received by those having electrical inspection in charge, asking under what conditions the series, parallel, or series-parallel connection of these lamps will be permitted for sign purposes. It is obvious that at these low voltages the National Electrical Code's permissive 660-watt rule is not sufficient, unless some additional limit, such as the Chicago regulation allowing only 12 sockets to each circuit, is specified. For at 10 volts a 660-watt branch circuit might be carrying 66 amp, a current strength entirely beyond the intended capacity of the equipment and wiring usually furnished. The use of such currents would involve the redesign of many fittings in order that their binding posts and contact pieces might take the larger conductor required.

With a view to agreeing on some tentative ruling to govern branch circuits of low-voltage lamps, representatives of the Underwriters' Laboratories, the Underwriters' National Electric Association and the Chicago city inspection department recently met in Chicago and formulated the following:

For low-voltage circuits employing pressures not exceeding 50 volts, current strengths per branch circuit not greater than 12 amp will be authorized.

For branch circuits of voltages lower than 50, the same 12-amp limiting current rule will apply.

The Chicago department is permitting the use of 10-volt tungsten lamps in series for outdoor sign purposes, but has not yet been confronted with the question of allowing this arrangement for indoor decorative or lighting purposes. The only installation of the latter kind in Chicago is the use of about 4000 4-cp, 12-volt lamps wired nine in series for lighting the mail-distributing cases of the Chicago postoffice, over which, as government property, the local inspection bureau has no jurisdiction.

The Chicago bureau allows, however, the series connection of such low-voltage lamps as the 27-volt type where all the lamps are on the same fixture (insulated from the piping system), and are controlled from one switch. The obvious drawbacks about the series connection of low-voltage lamps are the possibility of a ground occurring between the lamps of the series, overloading and breaking the one or more lamps which are subjected to the abnormal potential, and so involving fire risk; and the likelihood of different sizes of lamps being inserted in the series, which would overload the smaller units. For these reasons the installation of series lamps is confined to a close group of lamps all mounted on a single insulated fixture which is likely to be free from possible grounds.

TESTS OF ILLUMINATION OF A LARGE ARENA.

The lighting of the arena for the United States army tournament at Chicago, July 4 to 14, represents perhaps the most extensive flaming-arc lamp illumination of an outdoor field ever attempted. The arena itself measured 400 ft. x 600 ft., surrounding which were rising tiers of seats about 100 ft. deep, making a total area illuminated 600 ft. x 800 ft., or about 11 acres. The arena occupied an almost ideal location in a great sunken rectangular field left for a future flower garden by the graders in disposing the excavated material from the Chicago freight tunnels, with which the entire Grant Park lake front has been reclaimed. The tiers of seats, providing accommodations for about 40,000 persons, were built on the sloping sides of these banks.

Eighty 550-watt Aurola flaming-arc lamps, hung 50-ft. centers in 10 spans of eight each, furnished the field illumination. These lamps were suspended by drop wires, at a uniform height of 35 ft. above the arena, from the 600-ft. twin spans of steel messenger cables passing over 50-ft. poles set back of the seats, and guyed from the tops of 40-ft. poles, which were in turn anchored by deadmen. A maximum stress of about 15,000 lb. was employed in the span wires.

The lamps were supplied with 60-cycle alternating current, being operated two in series across each side of a 110-220-volt, three-wire circuit supplied from a temporary transformer installation.

As before noted, the lamps were of the 550-watt type, employing the V-arrangement of electrodes for giving the maximum downward distribution of light, most of the flux being included within an angle of 35 deg. from the vertical. Electrodes impregnated to produce a brilliant yellow light were used.

The events in the arena included all kinds of military maneuvers and drills by the infantry, cavalry, artillery, engineers' corps, signal corps, hospital corps and other branches of the regular service. Nearly 3000 soldiers took part. Performances were given daily at 2.30 and 8 p. m., the evening maneuvers making some kind of artificial illumination absolutely necessary.

The 80 flaming-arc lamps installed proved entirely adequate, providing illumination sufficient for all movements, even on

Under a lamp at edge of field	1.24	foot-candle
Under a lamp at center of field	0.91	" "
" " " " "	1.35	" "
Between two lamps in adjacent rows	0.84	" "
Between two lamps in same row	0.86	" "
Between four lamps	0.71	" "
Average	0.99	" "

the opposite side of the arena, to be seen easily. Some of those seated on the upper rows of seats experienced difficulty in clear vision, due to the glare of the luminous sources, in spite of the use of opal globes and the suspension of the lamps as high as was practicable. This difficulty did not amount to real discomfort, but was principally noticeable by contrast as, when the eyes were shaded, objects at the far side of the arena stood out with striking distinctness. Every one, including the soldiers who took part in the performances, seemed well pleased with the quality and intensity of the illumination, and many persons remarked the beauty of the scene when the lamps were turned on.

From a series of tests of the illumination of the field made with a Sharp-Millar photometer following one of the performances an average intensity of about 1 foot-candle was obtained. Readings taken at various points on the field selected at random gave the results shown in the accompanying table, each figure in the table representing the mean of five settings.

For the arena, 400 ft. x 600 ft., or 240,000 sq. ft., and assuming the 80 lamps to take their rated power, totaling 44,000 watts, the intensity of illumination obtained indicates a consumption of about 0.185 watt per lumen.

The special illumination of the tournament arena was erected by the construction department of the Commonwealth Edison Company and the energy for lighting the lamps was supplied by the company. The Aurola flaming-arc lamps were furnished by the Chicago office of the Charles L. Kiewert Company.

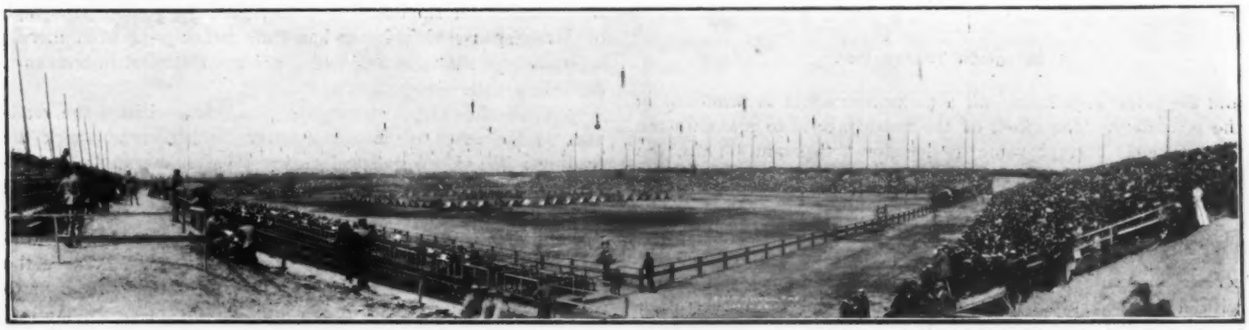


Fig. 1—Panoramic View of Arena During U. S. Army Manœuvres, Chicago.

NEW TELEPHONE PATENTS.

IMPROVED TRANSMISSION CIRCUITS

There have been a great many different circuit arrangements proposed for utilizing the telephone repeater. The chief aim in all of these is to devise an arrangement by which the repeated or reinforced currents will not react upon the circuits in a way to set up a singing of the apparatus.

It is with such a circuit that a patent recently issued to Mr. P. Stragiotti, of Hurley, Wis., is concerned. According to his plan the line is cut at the repeater station and each branch is led to an artificial line equivalent to it. Between the real and artificial lines, two induction coil secondaries are bridged, one pair of coils being associated with each branch of the line.

Two repeaters are used. The receiving element of one being looped into each branch of the line, between the two bridged induction coils. The transmitting elements are then associated with the opposite line branches by being connected in series with the two primaries of the induction coil, which in turn are connected to the two end terminals of a double-wound impedance coil. The mid points of the impedance coils are then connected together through a battery.

When an incoming telephone current arrives on one branch of the line, a major proportion of it passes through the receiving element of one repeater. The transmitting element of this sends out reinforced impulses through the connected induction coil primaries. These in turn produce effects in their secondaries, which being connected to circuits of equivalent constants, produce exactly equal effects. This, therefore, leaves the receiving element of the second repeater connected between equipotential points and therefore unaffected.

There is, further, no overlap of the two sets of primaries, as the impedance coils are so designed as to prevent any interdisturbance.

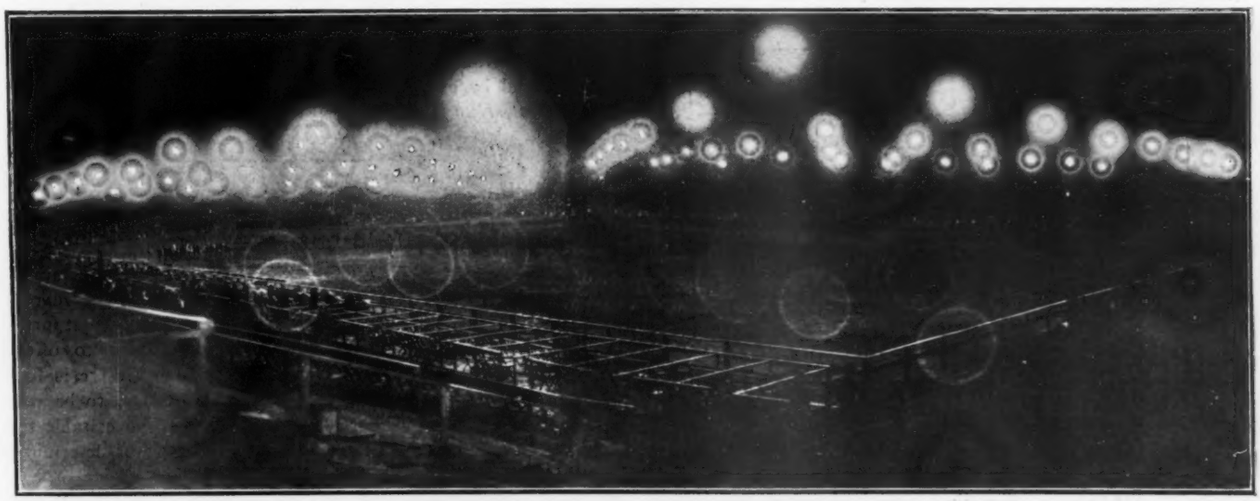
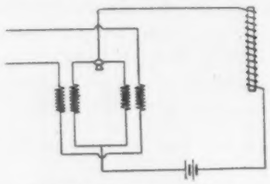


Fig. 2—Night View of Arena Lighted by 80 Flaming Arc Lamps.

In the cut is shown a circuit in which the same inventor has made use of a differential transmitter. The transmitter is in two sections, one increasing and the other simultaneously decreasing its resistance. By the use of the two induction coils



Stragiotti Transmitter.

and the large impedance coil a maximum effect is produced in the secondary. The effect of the impedance is to maintain the instantaneous current value in the circuit constant. Thus, the action of the transmitter is accompanied by a forced redistribution of the currents in its two circuits.

SERVICE METERING SYSTEM.

Mr. R. H. Manson has obtained a further patent upon his service metering system. This system contemplates a motor with a governor, which motor operates during conversation to drive a dial mechanism and thus to record the elapsed time of actual conversation. In the present arrangement a condenser bridges the motor armature terminals. To the Dean Electric Company has been assigned the patent.

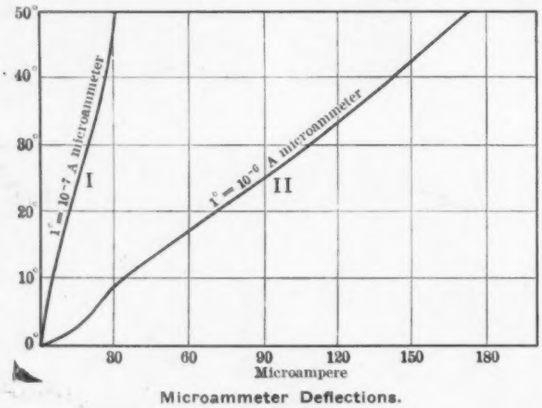
LETTERS TO THE EDITOR.

Locations of Vessels by Wireless Telegraphy.

To the Editor of Electrical World:

Sir: Your issue of July 22, 1909, contains a communication from the writer on the subject of location of vessels by wireless telegraphy, and I have waited a year hoping some one would suggest a better means than the one I proposed. As this has not come to pass, I wish to take up the subject again owing to its very great importance to the shipping industry.

In your issue of Aug. 12, 1909, Mr. Espenscheid says it is unlikely that an operator aboard a ship meeting with an accident would be disabled before his instruments are rendered useless. The case of Mr. Eccles, the hero of the ship *Ohio*, contradicts



Microammeter Deflections.

this view. This disaster happened near British Columbia, in August, 1909, I believe. Five lives were lost, among them being the operator Eccles. If he had died a few minutes before sending off telegrams 128 lives would have been lost. Wireless telegraphy of to-day is so compact and sturdy that the operator can easily be injured when the instruments would be undamaged.

Following are some considerations I wish to present:

1. I have raised the sensitiveness of my device, as shown in the above cut. With a microammeter (1 deg. = 1 micro-ampere, direct-current) the full deflection is reached at 170 micro-amperes. The more sensitive microammeter, 10 deg. = 1 micro-ampere, direct-current, has not yet been proved on ships, but I believe after some experiments it will also give good service. Naturally, if the differences of the readings at the angle points are small, the sides of the triangle should be taken larger. In my opinion ½-deg. readings are quite sufficient.

2. There are 20 milli-amperes constantly flowing through the barretters and compensating each other in the microammeter; this corresponds to $20.10^{-3} \times 20.10^{-3} 70 = 28{,}000$ micro-watts. The ship compass itself needs very little energy, and yet it is well adapted for shipboard use; therefore the second paragraph of Mr. Espenscheid's letter has little bearing. I need merely mention here that watches, which are not electrical instruments, need very little energy.

3. If the ship in peril is moving, and thus vitiates the readings of the rescuing ship, the latter can stop and check the readings. Of course, all cases cannot be enumerated; disturbing effects will make the readings wrong, but can be corrected in many cases. For instance, if the outgoing energy decreases constantly, as in the case of storage-cells running down, a difference can yet be noticed in the received energy, because the decrease of the latter cannot be the same in moving from or to the imperilled ship. I do not claim that my proposed method will succeed in every possible case, but if only one ship is rescued with its help my purpose is well attained.

4. Ships generally attempt to keep only the prescribed wave-length; for instance, if the length of 300 m is set, the first ship works with 295 m, the second with 298 m, the third with 310 m and so on. I found on the *Adria* that it is possible to select every wave-length and hear separately each ship; naturally, this needs instruments which measure better than the ears. Ears do not show differences at the maximum values, while the barretter measures these most exactly.

Mr. Espenscheid's last proposition, the determination of the position of the ship in peril by the help of two other rescuing ships, is an excellent one and is always applicable. If *C* is the imperilled ship, ship *A* can measure the distance from *C* and *B*; *B* can measure from *C* and *A*, and thus all three sides of the triangle are known. Whether *C* is on the left or right side a fifth measurement will decide at once.

In reference to the letter of Messrs. E. Bellini and A. Tosi (Sept. 9, 1909) I repeat again that "I willingly admit the superiority of the radio-goniometer, especially when a barretter-set is used instead of a telephone-receiver." But I am afraid it will take a considerable time for the "patented" methods to come in general use. My proposed method is not patented and can be used by every one.

Budapest, Hungary. Béla Gáti.

Rotating Incandescent Lamp Standards.

To the Editor of Electrical World:

Sir: In your editorial of July 7, on "Carbon-filament lamps as photometric standards," you raise the question why we rotate standard lamps when measuring them with highest precision, saying: "Incidentally, and without desiring to offer undue criticism, it may be asked what possible use there is for standardizing lamps on the hypothesis that they are to be rotated when in use. There may be cases when it is desirable to rotate a lamp under measurement for the purpose of determining its mean horizontal candle-power, although we hope to see this particular measurement soon dropped out of sight in favor of a mean spherical measurement expressed either in candles or lumens; but we fail to see the least necessity for having standard lamps, in which the highest precision is desired, exposed to the added risk of rotation to no possible good purpose. A standard with a filament of such contour as to give quite uniform horizontal distribution and furnished with suitable sight marks for alignment on the photometer bar is much more convenient and probably also more materially reliable than a rotating standard. Moreover, metallic-filament lamps,

which are already in very great commercial use, do not lend themselves readily to rotation, even if anyone wants to rotate them; and hence there is less use for real or imaginary measurements in rotation than there ever has been before."

There are a number of practical questions raised in this paragraph which we desire to answer.

1. As to "what possible use there is for standardizing lamps on the hypothesis that they are to be rotated when in use," we would say that the Bureau of Standards is constantly being called upon to standardize lamps for actual use in photometric measurements rotating, and must therefore maintain a complete equipment for the purpose. More measurements, by far, are actually made in practice with lamps rotating than stationary, and when a standard is used by the method of substitution it is preferably a rotating standard, when all the other lamps are rotating. We are therefore considering "real" measurements and not "imaginary" ones.

2. The Bureau employs both rotating and stationary standards, and has done so for years. Lamps to be used only stationary are generally made especially for the purpose. Rotating standards are usually of the standard oval anchored type. In seasoning and standardizing hundreds of these for practical standards, we are able to select the very best for standards of highest precision. In the course of our experience, in which many hundreds of standard carbon-filament lamps have been used and thousands of precision measurements made, we do not recall having broken a filament by rotation (180 r.p.m.), nor, so far as we know, done any lamp any harm by rotation. We measure the current and voltage to within about one part in 20,000 and equally well whether the lamp is rotating or stationary. We are not discussing fragile or experimental lamps, but the kind referred to in the paper commented upon.

3. As to the precision attainable in the measurement of rotating lamps, the opinion has sometimes been expressed that the slight flicker due to rotation is an objection and that more accurate settings can be made on stationary lamps. This is not, however, our experience. On the contrary, our most experienced photometricians find that they can set as closely on the rotating lamps as on the stationary lamps, and with less effort, for reasons which we cannot take the space to discuss here. We do not assert that the precision and consistency of measurements are greater with rotating lamps. But we believe that our recent results on rotating lamps are superior to any that we have seen published on either rotating or stationary lamps. We shall later make a more complete comparison of the possibilities of accuracy in the two cases.

The curves in Fig. 4 in our paper in the *Proceedings* of the A. I. E. E. are very disappointing, and do not fairly represent the original curves. No adequate idea of the constancy of the candle-power can be obtained from these, although the printed figures are correct. One point we especially emphasized is that the candle-power is constant even though the resistance and current vary considerably, provided that the voltage on the lamp during its life is so varied that the watts are kept constant. The detailed figures which justify our claims as to accuracy of measurement and constancy of value will be given in a fuller paper to be published in the near future in the *Bulletin* of the Bureau of Standards.

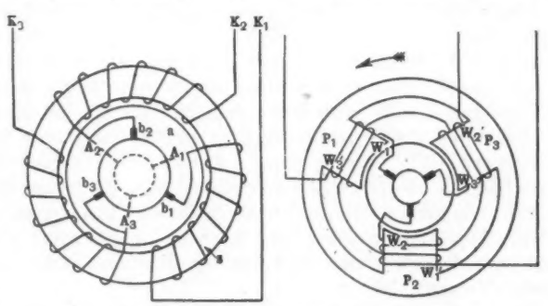
EDWARD B. ROSA,
GEO. W. MIDDLEKAUF,
Washington, D. C. *Bureau of Standards.*

Digest of Current Electrical Literature

ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD

Generators, Motors and Transformers.

Cascade Connection of Induction Motor and Commutator Motor.—R. O. KAPP.—An illustrated article on a method in which an ordinary induction motor works directly on the mains, and has in its rotor circuit a three-phase commutator motor which supplies the necessary back e.m.f. to effect speed variation, and gives up the power it absorbs either to the main shaft or to some other shaft running at a constant speed, or drives a generator, which puts power back into the mains. The advantages of this system are: (1) The speed can be regulated in as many steps as are required; (2) The loss of efficiency is very small; (3) The power factor can be improved, so as to be unity, thus making a smaller induction motor possible; (4) Any required relation between speed and load is possible, as in the case of direct-current machines. A method of this kind developed by Brown, Boveri & Co. and employing the Scherbius commutator motor is described in detail. The chief feature of the Scherbius motor is that it has the characteristics of a direct-current machine. The rotor is a drum-wound armature with commutator. The stator has two windings. One is for excitation, the other is a "compensating" winding. The latter is a drum winding, arranged to be electrically an exact counterpart of the rotor. Its function is to counteract the transformer e.m.f. induced in the rotor by the rotating field. In the Scherbius motor the compensating winding is connected to the brushes in opposition to the armature, as shown in Fig. 1. The exciting winding is not shown. When the machine is at rest the transformer e.m.fs. generated in the compensating winding and the rotor are equal and vectorially opposed, so that the resultant e.m.f. between the brushes is zero. When the machine starts running, the rotor e.m.f. becomes lower as the difference of speed of rotation between field and rotor decreases, but the e.m.f. induced in the compensating winding remains constant. These two no longer balance and there remains at the terminals an e.m.f. equal to their difference. Eventually no e.m.f. is induced in the rotor, and the back e.m.f. is equal to that of the compensating winding only. The motor runs equally well above synchronous speed if a higher e.m.f. is impressed, the back e.m.f. of the rotor and the compensating winding then acting in the same direction. It will be seen that the back e.m.f. is proportional to the speed, precisely as with a direct-current machine. In



Figs. 1 and 2—Diagram of Motor Connections.

order to compensate for the lag of the current behind the voltage in the main motor, the commutator or motor must have a leading current. To obtain this each field magnet is provided with separate windings from two phases as in Fig. 2. The flux vector is then the resultant of the current vectors in the two phases, and its position depends on the proportion of the number of coils from each phase. In this way it becomes possible to produce any required angle between the current and the e.m.f. by choosing a suitable combination of the exciting coils. An advantage of this type of motor is that it may be shunt, series or compound wound; in each case its behavior is precisely the same as that of a direct-current machine, and these properties are imparted to the whole set when it is worked in cascade with an induction motor. The applications which have hitherto been developed are: The driving of ventilating fans for mines, the driving of rolling mills, relief of

the central station of sudden loads with the help of a flywheel; the working of turbo air compressors which require a motor that can run above synchronism. A flywheel buffer set as employed at the Stordö Kisgruber in Norway is illustrated in Fig. 3. It is the main motor and in this case use is made of a double-commutator motor of which the speed is regulated by means of the lever *h*. The flywheel is not on the same shaft as the motor, which takes the full power, but on the shaft of a

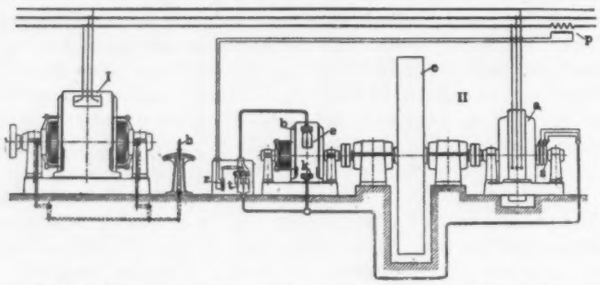


Fig 3—Diagram of Connections for Flywheel Buffer Set.

separate set connected in parallel with the main motor. This set consists of the Scherbius motor *b*, the flywheel *c* and a three-phase induction motor all on one shaft. A series transformer *P* in the mains is connected to a relay *r*; *t* is an auto-transformer, through which the motor *b* is excited. When the load becomes heavy, the relay *r* works a regulating device in the auto-transformer, which strengthens the field of the shunt-wound commutator motor *b*. This motor is connected across the slip-rings of *a*, which starts to run more slowly owing to the increased back e.m.f. The flywheel is made to give up some of its energy and drives *a* as a non-synchronous generator, which supplies energy to the mains. In order that this may happen, the e.m.f. of *b* must exceed that across the slip-rings of *a*. The field of *b* must be adjusted so that this happens at the required speed. *A* will act equally well as a generator whether it be running above or below synchronism. In this method by far the greater part of the energy is taken directly by the working motor, and only that which varies above or below the average goes through more than one machine, so the efficiency is good.—Lond. *Electrician*, July 8.

Alternating-Current Commutator Motors for Constant Speed.—F. Niethammer.—If a simple alternating-current commutator motor with direct-current armature is provided with two brush axles perpendicular to each other, both sets of brushes being short-circuited, the motor behaves in general like a single-phase induction motor; at no load it assumes about synchronous speed while with increasing load the slip increases; when operated above synchronism, it can return energy into the network. The starting torque is zero. The author discusses how the motor can be started and how the power factor can be improved. Several modifications of this design, especially those due to Fynn, and built by two German companies, are described and illustrated by diagrams.—*Elek. und Masch.* (Vienna), July 3.

Mutual Induction.—J. Rezelman.—A mathematical paper, illustrated by diagrams, on the determination of the mutual induction between the external coil connections of dynamo-electric machinery.—*La Lumière Elec.*, July 2.

Lamps and Lighting.

Flame Arc Lamps.—E. W. Marchant.—An article on the use of flame and other arc lamps for exterior illumination. In the ordinary vertical electrode arc the maximum illumination occurs at an angle of from 40 deg. to 60 deg. below the horizontal. In the inclined electrode lamp the maximum intensity of illumination is in a direction vertically underneath the arc. This alteration in distribution of light is a disadvantage, since it gives maximum effect immediately below the lamp. The following results were obtained in efficiency tests made without globes, the arc consuming in each case 10 amp at 45 volts.

	Mean Hemispherical Candle Power	Watt per M. H. S. C. P.
Yellow-flame lamp	2,650	0.144
White-flame lamp	1,270	0.338
Ordinary carbon arc lamp	620	0.69

The use of globes with the lamps reduces the cp very greatly. With the globes used on the flame lamps the light was usually reduced to about one-sixth of its former value, though in some cases the absorption of the globe was even greater, the light emerging being only one-tenth of that actually produced by the lamp. The following results were obtained in tests made with globes otherwise under the same conditions as before.

	Mean Hemispherical Candle Power	Watt per M. H. S. C. P.
Yellow-flame lamp	360	1.05
White-flame lamp	200	2.15
Ordinary carbon arc lamp	190	2.25

It is questionable whether globes which absorb so much light should be used, but the author thinks that these globes are very brilliant and conspicuous objects when the lamp is burning, and where a lamp is used (as it is in many cases) for spectacular purposes the brilliance of the globe becomes of practical utility. At the same time, where illumination is wanted, it is obvious that a comparatively clear globe should be employed.—*Illum. Eng.* (London), June.

Moore Vacuum Tube.—P. Heyck.—A letter in which the author criticises Wedding's recent article in which the Moore vacuum tube lamp was compared with indirect illumination by means of incandescent lamps and arc lamps. To prove that the Moore tube is not more economical, the following figures are given: The Moore tube consumes, according to Wedding, 3304 watts, giving a mean horizontal illumination of the floor of 39.4 lux, the area of the floor being 17.4 m x 8.6 m = 150 sq. m. This gives a specific consumption of 0.56 watt per lux-sq. m. Corresponding measurements with arc lamps have shown that the specific consumption of an open direct-current arc lamp with pure carbon electrodes and with entirely indirect illumination is 0.212 watt per lux-sq. m. The same lamp with normally-arranged carbon electrodes and semi-indirect illumination consumes 0.262 watt per lux-sq. m. The open alternating-current arc lamp with pure carbon electrodes and entirely indirect illumination consumes 0.355 watt per lux-sq. m. The room in which these measurements were made had been painted five years ago so that the ceiling was no longer a very good reflector. Wedding remarked that Heyck gave no data on the maximum and minimum illumination obtained in tests and said that the Moore lamp gives a more uniform illumination.—*Elek. Zeit.*, July 7.

Photometers.—An illustrated article on various photometers and illuminometers recently exhibited at the Municipal Exhibition in London. Photometers of the three classes, quality of brightness, contrast, and flicker, were represented. Of commercial testing instruments the Trotter "universal photometer" and the Harrison street photometer are described. Finally mention is made of the Thorner illumination tester which enables a rough idea to be formed as to whether the daylight illumination in a room is satisfactory or not. The instrument really compares the brightness of an image of the sky with the actual illumination to be examined. It consists of an inclosed box the interior of which is arranged as shown in Fig. 4. It contains a sheet of paper *fg* with an aperture at *a*. Vertically above this fine aperture *a* is to be found a convex lens *d* and an inclined plane mirror *e*, which can be rotated about both a horizontal and a vertical axis. The aperture *a* is situated at the focal length of the lens *d*. A second

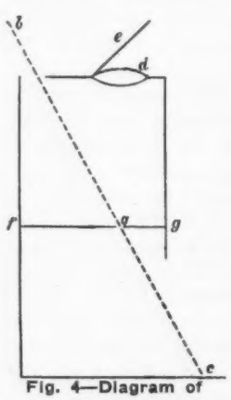


Fig. 4—Diagram of Photometer.

paper surface at *c* receives the available intensity of illumination to be examined. An observer, looking along the direction of the dotted line *bae*, sees the surface *fg* and this second surface through the aperture *a*. He then turns the mirror *e* in such a way that an image of a portion of the sky is formed on the region of the paper screen *fg*, adjacent to the aperture *a*. He now judges the value of the existing illumination by merely observing whether the surface illuminated at *c*, seen through the aperture, appears brighter than the image of the sky formed on *fg*, or vice versa. If it appears darker, as shown in the left-hand diagram of Fig. 5, the illumination is said to be too weak. If,

Fig. 5—Values of Illumination.

on the other hand, the spot appears brighter, as in the right-hand diagram, the illumination is judged to be sufficiently bright. Of course, it may happen that no portion of the sky is visible from certain positions in a room. When this happens, however, it is safe to condemn the daylight illumination in the room without further test. As the standard brightness of the image of the sky is to some extent an arbitrary value, several stops are provided, which correspond to illuminations in the ratio 1, 1½ and 2. Determinations are best carried out in cloudy weather. Naturally precautions must be taken to avoid abnormal conditions. The effects of a heavy fall of snow, for instance, and the light reflected upward as a result, would cause an abnormal distribution of illumination in the room tested. In the same way results obtained when the sunlight is streaming directly into the room will be too high, while, in the case of a clear sky, the process of testing is somewhat affected by the fact that the image of the sky appears a different color to the aperture.—*Illum. Eng.* (London), June.

Metallic-Filament Lamps and Shock.—TH. MULLER.—An English translation of his recent German paper describing an experimental method for determining the resisting power of metallic-filament lamps against mechanical shock.—Lond. *Elec. Rev.*, July 8.

Metallic-Filament Lamps.—F. JACOBSOHN.—The conclusion of his article on the development and prospects of the metallic-filament incandescent lamp with useful references to existing literature and patents.—*Illum. Eng.* (London), June.

Projector Lanterns.—C. W. DENNY.—An illustrated article suggesting an automatic method of magnetic control of large projector lanterns.—Lond. *Elec. Rev.*, July 8.

Light Houses.—J. BENARD.—An illustrated article on the lighting of light houses by electricity and giving a sketch of the progress made in the equipment of light houses in the last 100 years.—*La Revue Elec.*, June 30.

Photometric Curves.—J. S. CODMAN.—An article describing a simple method of finding quickly the mean cp and flux from photometric curves when plotted on ordinary polar paper.—*Illum. Eng.*, July.

Photometry of Street Lamps.—H. E. HARRISON.—A general discussion of methods of photometry of street lamps with reference to the errors due to variations in standard lamps, errors due to observation, and errors due to angular uncertainties.—*Illum. Eng.* (London), June.

Generation, Transmission and Distribution.

Trient.—F. RUDOLPH.—The conclusion of his illustrated description of the electric plant of the city of Trient in Austria. For transmission from the power station to Trient the e.m.f. of the three-phase currents is raised from 5250 volts to 20,000 volts. At the main transformer station in Trient the e.m.f. is reduced from 19,000 volts to 5000 volts and three-phase currents at 5000 volts are distributed through the outlying districts of the city where seven transformer stations are provided for reducing the e.m.f. from 5000 volts to 225 volts for the supply to consumers. The center of the city is supplied with direct current from an existing station, but as the generating equipment was not sufficient, part of the three-phase currents is supplied to this station and converted to direct current by motor generators.—*Elek. und Masch.* (Vienna), July 3.

Steam Turbines.—RATEAU.—An abstract of a paper read before the International Mining Congress at Düsseldorf on exhaust steam and mixed-pressure turbines. The first mixed-pressure turbines were made with two bodies, one for high and the other for low pressure; the present turbines comprise, in a single body, a range of high-pressure wheels and another range of low-pressure wheels; the exhaust steam enters an annular port between the two ranges. The regulation of these engines is not dependent solely upon the speed governor, because in this event the steam from the accumulator would flow freely into the turbine, and its pressure would fall very low for high-pressure operation; moreover, this method of regulation requires speed variations that would render impossible the paralleling of alternators driven by mixed-pressure turbines with those of the other groups. The author solved the problem by causing the speed governor to act upon both inlet valves together, the latter controlling each other without acting on the speed governor. A spring tends to hold the low-pressure valve open, and consequently to close the high-pressure valve. On the other hand, the low-pressure valve is subjected to the pressure variations of the accumulator as soon as the pressure sinks beneath a certain value. The movements it receives are, at the same time, transmitted to the high-pressure valve, which enables one kind of steam to be replaced by the other, without the speed varying. The author then points out an objection that was made regarding high-pressure operation of mixed turbines, and shows that by a suitable selection of the number of wheels, an efficiency can be obtained with these turbines which is equivalent to that of high-pressure turbines.—Supplement to Lond. *Elec. Eng'ing*, July 7.

Steam Turbines.—J. McK. NEWTON.—The first part of a paper, illustrated by numerous diagrams, on high-speed steam-turbine rotor design and construction.—Lond. *Eng'ing*, July 8.

Electric Drills.—W. KOHLMANN.—An abstract of a paper read at the International Mining Congress at Düsseldorf on the development of the mining industry in the Minette district. It was mentioned that the necessity of providing compressed air for drills was inconvenient, as it was only used for this purpose. The Siemens & Halske rotary drill had been used to some extent, but in the author's opinion the drill of the future is the electrically-operated percussion drill, a majority of the Minnette mines having at their disposal a source of supply of cheap electrical energy in the adjacent smelting works, and there being no difficulty in the way of laying electric cables in the mines. However, up to the present the available forms of electric percussion drills do not fulfil the requirements of the work. In the underground haulage, which presents no difficulty, the haulage roads being wide and usually straight, electric locomotives and endless ropeways have largely replaced horse traction during the past few years.—Supplement to Lond. *Elec. Eng'ing*, July 7.

Electric Pumping.—SCHULTZE.—An abstract of a paper read before the International Mining Congress at Düsseldorf. The author described a particularly compact electrically operated plunger pump of German make, at work in a shaft of the Zollverein colliery. The machine, which is able to raise 138 gal. of water per minute against a total head of 1443 ft., consists of three single-action plunger pumps. The whole set, though accessible in every part, is so compact that the foundation occupies a space of only 6.5 ft. by 10.5 ft.—Supplement to Lond. *Elec. Eng'ing*, July 7.

Electricity in Agriculture.—H. WALLEM.—The first part of a paper in which the author discusses the various applications of electric motors for driving agricultural machinery, especially threshing machines. The article is to be continued.—*Elek. Zeit.*, July 7.

Traction.

Railless Traction.—H. ENGLAND.—A paper read before the Tramways and Light Railways Association at Dublin. The au-

thor first refers to the unsatisfactory financial results shown by the majority of tramways in England, and discusses the conditions under which a tramway running in a sparsely populated district can be made a profitable investment. At present railless traction seems to offer the only satisfactory method of extending operations. He then describes the various systems of railless traction in use and gives particulars of the working costs and cost of construction; and finally refers to the difficulty and expense in obtaining franchises for the operation of railless schemes.—Lond. *Electrician*, July 8.

Installations, Systems and Appliances.

Battery Plant in Colliery.—W. Maurice.—A paper read before the Inst. of Mining Engineers in London on the storage battery plant at the Hucknall colliery. The battery plant is used for the supply of direct current in a pit (No. 1 pit) in which the original small direct-current generating plant had become insufficient to cope with the load. The energy transmitted to the battery plant is the surplus from a generating plant supplying a three-phase system in another (No. 2) pit about 1.3 miles distant. Fig. 6 shows the arrangement. The

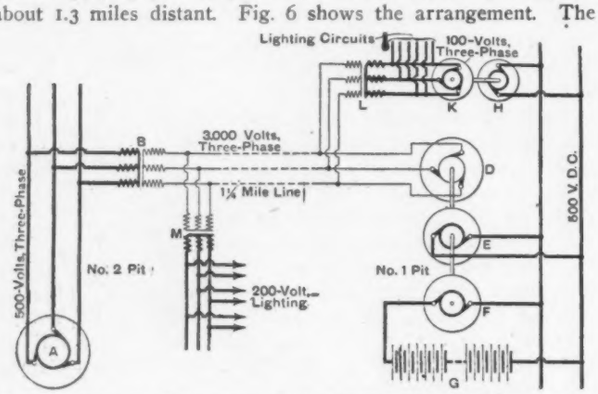


Fig. 6—Diagram of Connections of Generating and Battery Plant.

110-kw Rateau exhaust-steam plant *A* generates three-phase currents at 500 volts and supplies energy to the underground haulage gear in No. 2 pit with a fluctuating load varying between zero and the full output of the generator. A 90-kw transformer *B* steps up the pressure to 3000 volts, and the surplus energy is transmitted over an overhead line to No. 1 pit, where it is converted to direct current by means of a motor-generator set. This set consists of a 3000-volt synchronous motor, *D*, coupled to a 50-kw, 500-volt, compounded direct-current generator *E*. A Lancashire reversible booster, *F*, for automatically regulating the working of the battery, is coupled to the same shaft. The battery *G* consists of 240 cells with a total rating of 400 amp-hours on the 10-hour discharge rate, or 236 amp-hours on the 1-hour rate. For the purpose of supplying energy for the alternating-current lighting loads of both pits from the battery when the generator *A* is shut down, a small motor-generator set, *H*, *K*, has been installed, connected to the high-tension line through a transformer, *L*. The lighting circuits at No. 2 pit are supplied at 200 volts alternating current through the 3000-200-volt transformer, *M*, and those of No. 1 pit and of the adjoining offices and private houses are supplied at 100 volts alternating current from the generator *K*, or through the transformer *L*, when the main generator is running. The small original direct-current generator set in No. 1 pit has been retained, and is electrically connected to the battery plant; this machine is generally used as a motor to drive a 36-in. circular saw, but it can be driven as a generator by the original steam engine, and then assists the battery plant. During the time when the generator *A* is running—usually 16 hours per day and five days per week—the generator set, *D*, *E*, *F*, also runs, the generator supplying energy for the load at No. 1 pit, and at the same time charging the battery through the booster, *F*. Whenever the haulage-load on set *A* increases, the motor-generator tends to drop its load, and the charging current supplied to the battery falls off. In case of a heavy overload on the haulage system the motor-generator reverses, taking energy from the battery, and returning it to the generating station to assist the generator *A*. Any fluctuations in the load at No. 1 pit are meanwhile taken care of by the automatic reversible booster, so that all of the fluctuations are taken up by the battery, the output of the direct-current generator not being affected. Thus the generating set, *A*, is kept running at or near full load; the motor-generator supplies energy to No. 1 pit, and any surplus is stored in the battery. When the battery is fully charged, the motor-generator set is shut down, and energy for the load at No. 1 pit is supplied from the battery for the remainder of the 24 hours. The total equipment installed in the two pits is rated at about 300 hp. In the discussion Mr. W. C. Mountain thought he would not care to put a battery into a colliery; five or six years ago this was done in a German colliery at a cost of $45,000 and it had to be scrapped after less than a year's working. Mr. D. S. Bigge suggested that it would have been more economical to increase the turbine generating plant provided more exhaust steam was available. The author replied that more exhaust steam was available but additional turbine plant together with the transmission line would have cost very much more than the battery plant. He had arranged with the battery manufacturer for a ten years' maintenance contract at a very low cost.—Supplement to Lond. *Elec. Eng'ing*, July 7.

Earthing in Mines.—W. Foster.—An abstract of a paper read before the Warwickshire and South Staffordshire Section of the Association of Mining Electrical Engineers. He started by describing the measurements he had made to determine the maximum pressure permissible in the earthing system. The arrangement of his tests is shown in Fig. 7. Direct current was employed. The first reading was taken as soon as the person

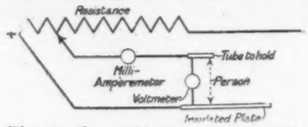


Fig. 7—Grounding Arrangement.

felt the effects of the current, and continued until the maximum was reached which the person would stand voluntarily. Seventy-two tests were made. A few samples of these are given below:

Volts	Amperes	Ohms
110	0.12	916
74	0.22	336
55	0.3	183
36	0.25	144
32	0.3	107
16	0.072	222

Each person's resistance had fallen toward the end of test, owing, probably to the perspiration on the hand. Seeing that a person would not stand voluntarily more than 32 volts, at which pressure he was taking 0.3 amp, it appears inadvisable to allow a potential difference between earthed metal work and earth of more than 50 volts. The author then proceeded to discuss the earthing on different systems. In the two-wire insulated direct-current system, when only one fault occurs, the system balances itself about this fault, and no interruption is caused in the working; but should a second fault occur, there is a short-circuit across the system. With the concentric system any fault, as a rule, causes a short-circuit. A three-wire direct-current system, with neutral insulated is similar to the two-wire, but a reduced pressure is applied to the short-circuit. A three-phase system, with all three phases insulated, is like the two-wire direct-current system, and a three-phase system with neutral earthed corresponds to the three-wire direct-current system. He did not approve of the system of finding one good earth and making connection to it. In his opinion a system with well-distributed ground connections is best, more especially when protective apparatus is employed to isolate faulty sections; such apparatus requires only a small current to operate it, and inserts only a small resistance in the earth connection. Mr. English, in discussing the paper, agreed with the author's recommendation to distribute the earth connections as generally as possible. He further stated that in his experiments 800 ohms was the lowest resistance of a human

body under conditions similar to those described in the paper. —Supplement to Lond. *Elec. Eng'ing*, July 7.

Electric Cooking.—K. WILKENS.—An article in which the author endeavors to show that electric cooking can be made commercially profitable since the time when energy is used for cooking is not coincident with the time of the peak load of the station. To introduce electric cooking on a large scale it is necessary to provide a suitable rate for service. Various methods are discussed. The simplest is one in which the consumer is charged not for the kw-hours but for the kilowatts, a device being installed which limits the amount of power that can be taken from the mains. The same rate is therefore charged for lighting, cooking, motor drive, etc.—*Elek. Zeit.*, July 7.

Electric Valves.—A. TIAN.—An article on the application of electric (aluminum) valves for the protection of the field-magnet circuit at the moment of interruption of the circuit. The author claims the electric valve to be a very effective means of protection.—*La Lumière Elec.*, July 2.

Wires, Wiring and Conduits.

Protection of Insulated High-Tension Wires.—H. WOMMELSDORF.—A critical discussion of an uncertain point in the rules of the German Association of Electrical Engineers concerning the protection of insulated high-tension conductors in electric plants. The author thinks that one of these rules is not clearly stated and that in many cases the conductors in German electric plants, especially in 500-volt, three-phase plants, are therefore not properly installed.—*Elek. Zeit.*, June 30.

Fuses.—HUNDHAUSEN.—An illustrated paper on a system of non-interchangeable electric fuses.—*Elek. Zeit.*, June 23 and 30.

Electrophysics and Magnetism.

Radium Emanation in the Atmosphere.—J. SATTERLY.—An account of an investigation on the amount of radium emanation in the lower regions of the atmosphere and its variation with the weather, made during one whole year in Cambridge, England. The cocoanut charcoal method was employed. The average radium equivalent per cubic meter is 105 gm x 10^{-13} gm. The lowest value is 35 gm x 10^{-13} gm, and the highest 350 gm x 10^{-13} gm, a ratio of 1:10. The amount of emanation is usually lowest during cyclones, that is, during windy, wet weather, when the barometer is low; it is usually highest during anticyclones, that is during dry weather with light variable winds and a high barometer. In cases where this rule breaks down, a study of the trajectories of the surface air-currents reveals that when air has traveled over the sea to Cambridge or very rapidly over land, the emanation content is low, while when the air has spent much time over land, the emanation content is high. The results of other experiments are discussed; Eve's results obtained by a similar method at Montreal differ from the author's, but this is probably due to different geographical conditions. Experiments made by measuring the active deposits on exposed wires seem to give misleading and indefinite results. The number of ions produced per cc per second in free air at Cambridge due to the radium emanation present is about 2.1 on the average, with a minimum value of 0.7 and a maximum value of 7.0.—*Phil. Mag.*, July.

Transient Phenomena.—K. W. WAGNER.—Some theoretical notes on some simple transient phenomena which take place before the stationary condition in an alternating-current circuit is reached, and the technical importance of such transient phenomena.—*Elek. Zeit.*, June 30.

Hertzian Waves.—H. POINCARÉ.—The conclusion of his mathematical paper on the diffraction of Hertzian waves.—*La Lumière Elec.*, July 2.

Units, Measurements and Instruments.

Cradle Dynamometer.—J. DAVIES AND F. SHAW.—A paper read before the Manchester Section of the (Brit.) Inst. Elec. Eng. on the application of the cradle dynamometer to the testing of electrical machinery. After referring to early applications of the cradle-dynamometer principle to the testing of electrical machines, the authors describe a dynamometer used at the Manchester School of Technology, the cradle being supported on ball bearings instead of the customary knife edges. Particulars of experiments with this machine are given, and also some results for the relation between hysteresis and eddy-current losses and the flux density in the air-gap.—Lond. *Electrician*, July 8.

Excess Voltage Indicator.—A note on a recent British patent issued to V. Arcioni. (14,965, 1909; June 30th, 1910). This is an alternating-current induction relay in which a spring-controlled metallic disk is acted on by shunt magnets connected between each phase or side of the system and earth. The form of the instrument is such that the torque due to the magnets being out of phase is negligible. The disk has a gap opposite but unsymmetrical to each magnet pole. Each magnet exerts its own torque on the disk independently, so that excess voltage between phases or between any one phase and earth will have effect.—Lond. *Elec. Eng'ing*, July 7.

Telegraphy, Telephony and Signals.

Telephone Progress.—B. GATI.—The author makes some remarks on Brown's telephone relay, together with other notes on recent progress in telephony. He refers to his microphones, which are water-cooled, work with 1 amp and speak to a distance of 2500 km on a 4-mm diameter bronze-wire circuit. The new microphones overcome a line resistance which is 1000 times as great as before. He then gives some records of disturbing currents which occur on the best Hungarian lines and asks what effect the telephone relay would have. His reply is that it would strengthen the disturbing currents and produce at the end of the circuit a terrible noise. For alternating (high-frequency) telegraphy he finds the relay of Brown a wonderful help. Working on modern (highly self-inductive) cables, the resonating effect shuts out entirely the disturbing currents; in this case with aid of the relay, it is possible to actuate, for instance, a Siemens-Halske or Creed rapid printing set.—Lond. *Electrician*, July 8.

Loaded Telephone Cables.—F. JACOB.—A communication on the effect of leakage on loaded telephone cables and the attenuation coefficient.—Lond. *Electrician*, July 8.

Miscellaneous.

The Frequency of a Lightning Flash.—F. EMDE.—For the protection of electric installations against lightning flashes it is of importance to know the frequency of oscillographic atmospheric discharges. The author treats this problem mathematically, considering the electromagnetic field of a lightning flash between the cloud and the earth as a vertical cylinder, the outer surface of which has at all times a zero magnetic intensity. The calculations of the author are based on Maxwell's theory, and a comparatively simple formula is found for the fundamental frequency. This is between 2000 and 8000 cycles per second; the average being about 5000 cycles. When the electric field is approximately uniform, before the lightning flash started, the amplitudes of the higher harmonics are comparatively small and it is sufficient to consider the fundamental oscillation alone.—*Elek. Zeit.*, July 7.

BOOK REVIEWS

INDEX TO PROCEEDINGS OF NATIONAL ELECTRIC LIGHT ASSOCIATION. 1885 to 1909. New York: National Electric Light Association. 243 pages.

This Index is based on a plan originally prepared some years ago for a proposed index to the *Transactions* of the American Institute of Electrical Engineers. President C. L. Edgar during his administration of the National Electric Light Association in 1904-5, took direct charge of the execution of the task, and the briefs to accompany the classified entries of papers were prepared by members of his professional staff during a period of several years, most of the work being done by Mr. E. S. Mansfield. The plan of the index is based in part on the syllabus method of law reports, and in detail is as follows: Each paper is the subject of a syllabus or brief which notes the significant points covered by the paper, the briefs being classified chronologically in the present case under twenty-four

classes of main subjects. There is also an author index and a general word index. One seeking for information on a given subject first glances through the briefs in the class representing that subject, in order to determine which paper or papers printed in the *Proceedings* contain the specific information he seeks. This system relieves him from the necessity of taking down all the volumes containing papers on the subject, some or many of which, after the expenditure of time in examination, he might find did not include anything of specific interest to him. Should he wish to follow up a subject closely, he will next have recourse to the general index for references to papers in other classes where the subject is treated incidentally to the main topic of such papers; these index references are to the briefed entries in order that one need not take down all of the corresponding volumes of the *Proceedings* in order to learn if the information is along the lines he is following up.

By this system, one first jots down the volume and page references to papers he has selected after a glance through the classified briefed entries; he may then in addition jot down additional references found in the general index which relate to the subject in hand, check these by returning to the classified briefs, and mark off those which he thus finds do not interest him specifically. He has then a final list to everything in the *Proceedings* in which he is at the moment interested, and only the volumes thus closely selected need be taken from the shelf for consultation.

The preparation of a syllabus or brief of a few lines that will characterize properly a paper of some thousands of words, is obviously not a simple matter, and Mr. Mansfield and his collaborators are to be congratulated upon the successful manner in which they carried out this essential part of the work. Much credit is also due to Mrs. C. S. Gale, who prepared the general index and put all of the matter in form for the printer.

In future editions of the index several changes in make-up can be made with advantage. For example, at present the general index precedes the classified briefs, though the latter form the important section of the work, and the index entries refer to them. There appears to be no reason why the author index should be in type larger than that of the general index, particularly as the larger type used actually detracts from legibility. The reference numbers in the general index are rather formidable in appearance. This is owing to a departure from the original plan of the work, through the use of references both to the classified briefs and to the volumes of the *Proceedings*. This duplication appears to be unnecessary, as the time required to refer initially to the briefs would be much less in almost every case than the time required to take down the various volumes of *Proceedings* and examine lengthy papers in order to determine if the information contained is of the kind sought.

A part of the original scheme of the index was to print in each annual volume of *Proceedings*, briefs of, and a general index to, the papers in that volume, this matter to be prepared according to the plan of the separately printed main index. By this means not only would each volume be well-indexed in itself, but the matter thus printed would be on hand as material to bring the separately printed index up to date from time to time in new editions. This plan is partly recognized in the *Proceedings* for 1909, and the index section of that volume is reprinted as a supplement to the present Index volume. Unfortunately, however, instead of briefs suitable for later incorporation in their appropriate classes, abstracts of considerable length are given of the papers; and the general index is in such great detail as not to be suitable for direct incorporation with the main general index. A special technical index like the present one should have essentially the character of a finding index, as presumably it will be consulted for serious purposes that would not be served by a collection of abstracts which, even if of considerable length and satisfactorily compiled, would rarely if ever obviate final recourse to the original papers.

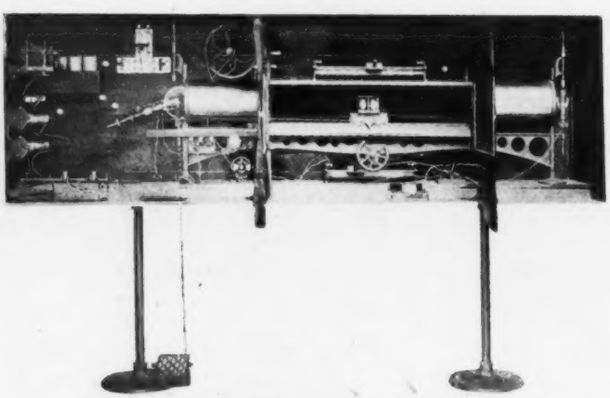
To the fortunate possessor of a file of the *Proceedings* of the National Electric Light Association, the present volume will be a prize, and particularly so to public reference libraries containing a set. The *Proceedings* date from the very beginnings of the central station industry, and their pages reflect every step in its technical and commercial evolution. This valuable mine of information, heretofore inaccessible, owing to lack of guidance to its treasure, is now opened in a manner that enables every nugget to be quickly located.

New Apparatus and Appliances

COMBINATION PHOTOMETRIC AND VACUUM TESTING OUTFIT.

Purchasers of incandescent lamps desiring to install a testing outfit, and who do not have at their disposal a dark room, will doubtless be interested in the photometric apparatus shown herewith, which has just been placed on the market by the Dwyer Machine Company, of Lynn, Mass. The photometer is enclosed within a large case which, together with curtains, protects the sensitive screen from stray sources of light. The inside of the case is darkened, and the inside of the photometer proper is lined with black velvet. Photometers are supplied for measuring the candle-power of tungsten-filament lamps up to 1000 cp.

The lamps may be lighted on testing sockets independent of the photometer, and the light graduated by means of rheostats from red heat to rated candle-power or above for the purpose of discovering bright spots on the filaments. Lamps with filaments containing any brightness, or with filaments not of a uniform temperature throughout their length, are usually considered defective. The apparatus has also provision for testing the vacuum of lamps. Of all the tests made on incandescent lamps that for vacuum is the most important, because lamps with varying vacuum will not give satisfactory service. Instructions accompanying the apparatus describe 10 degrees of vacuum and indicate the life which can be expected from each. To install the apparatus it is simply necessary to make two connections to the main circuit, when the devices are ready for immediate use.



Combination Photometric and Vacuum Testing Outfit.

RAPID ERECTION AND REMOVAL OF ELECTRIC CIRCUITS.

During the first week in June there was given in St. Louis, Mo., under the auspices of the National Benevolent Association a county fair. This was held in University City for the benefit of the Babies and Mothers' Home, and electricity was employed for lighting and heating throughout. The circuits were fed from the mains of the Union Electric Light & Power Company. Inasmuch as the fair was held during the week of the National Electric Light convention, the regular force of electric light men was naturally very busy entertaining visitors and attending to routine work. Three days were allotted in which to erect the poles and wire the buildings and tents used. Fig. 1 herewith shows the poles and main secondary wires, transformers and suspension of lamps, which were held by a Matthew's guy anchor at each end of the pole line. The anchor served a double purpose of holding both the strain of the wires and the weight of the arc lamps suspended 30 ft. apart from a stranded guy wire. By the use of quickly attached Matthew's line material, previously painted poles, malleable-iron pole brackets and porcelain strain insulators, the work was finished with dispatch. The problem consisted in erecting 19 poles; two 30-kw, one 40-kw and one 10-kw transformers; approximately 1½ miles of wire; hanging 72 arc lamps and 600 incandescent lamps, and connecting the service to each tent. This work was accomplished by two foremen, six linemen and four helpers in 24 hours. After the fair the entire outfit was removed by one foreman, four linemen and two helpers in 10 hours. Fig. 3 shows a crew of the Union Electric Light & Power Company pulling up and taking down a pole by means of jack screws. These poles were 35 ft. long and were pulled up bodily from the ground without digging around them at an average of less than five minutes each. The entire installation shows what can be done by good organization and labor-saving specialties in picking up unexpected and profitable business.

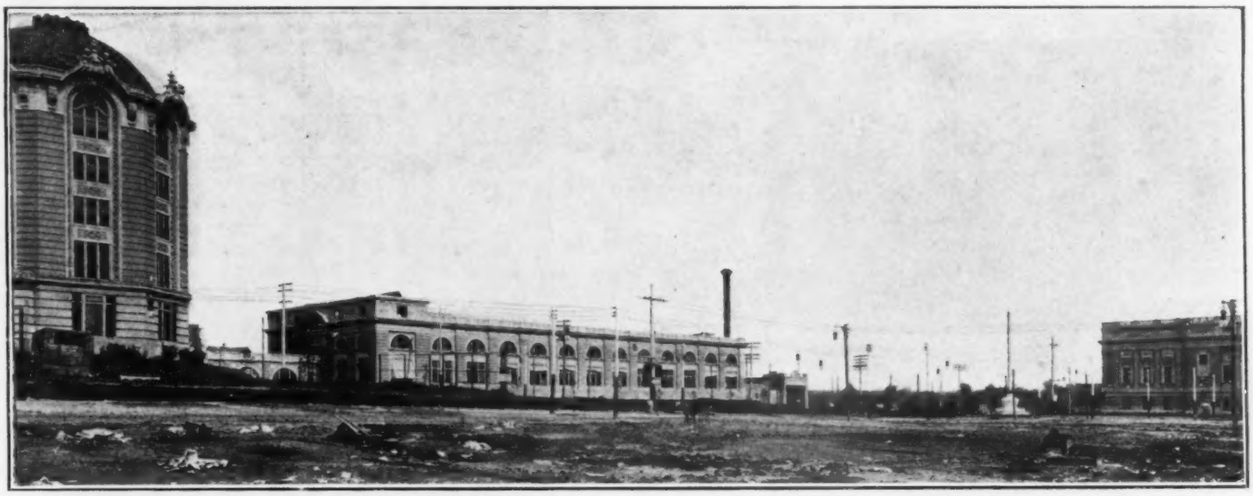


Fig. 1—General View of Grounds Without Tents, Etc.

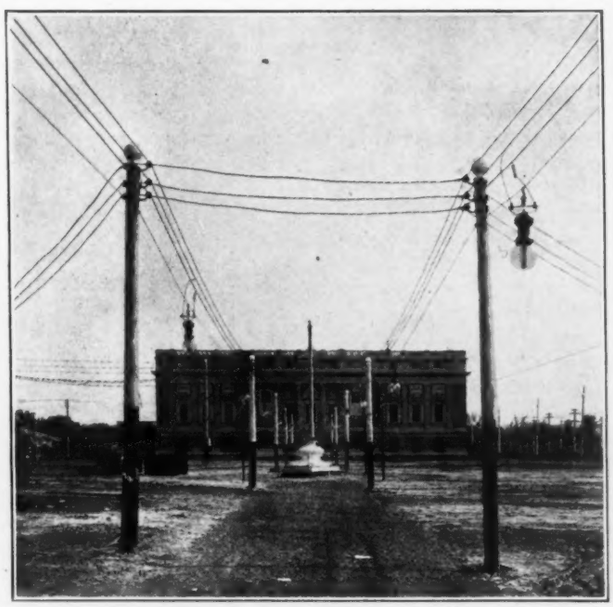


Fig. 2—View of Poles and Secondary Circuits.

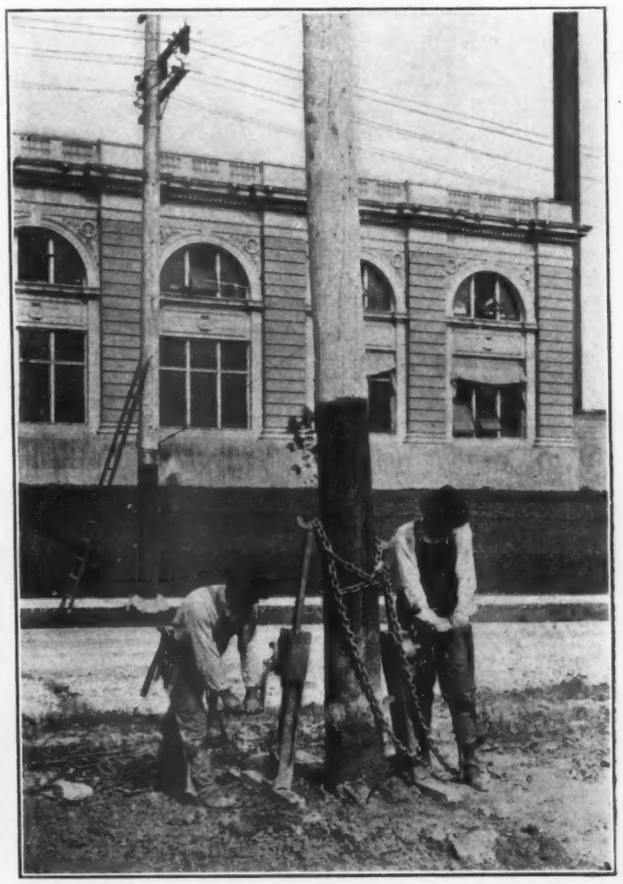


Fig. 3—Removing Poles By Means of Jackscrews.

COMBINATION WINDOW AND SIGN LAMP.

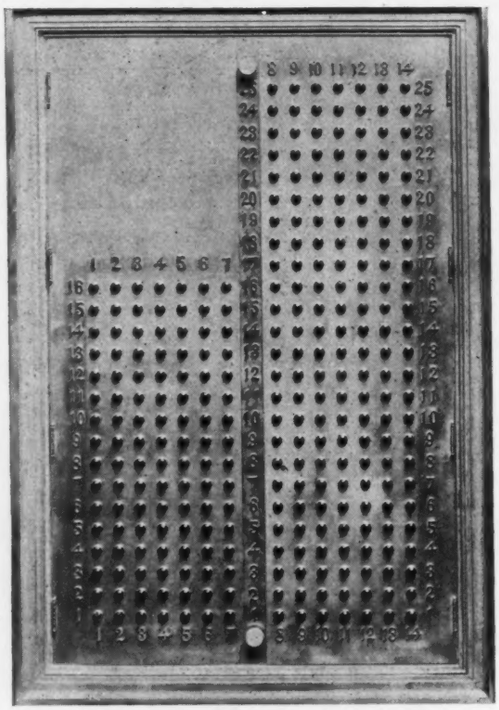
The Federal Electric Company, Chicago, manufactures a combination art-glass screen or sign for window work, the lamps for which also illuminate the window. The letters are made in colors contrasting with the background, and are all standard in size so as to slip easily into a grooved brass frame-

Combination Window and Sign Lamp.

work. The lamp reflectors being adjustable to any angle throw the light to best advantage upon the window display, the small amount of light which escapes through the shades being all that is necessary to illuminate the sign. The latter hangs close to the plate glass by heavy brass chains, and occupies space that cannot be utilized for any other purpose. The framework of the fixture consists primarily of a light, but strongly trussed, steel frame having brass-bound parallel runners or guides at the top and bottom. Electric lamp sockets are placed at regular intervals along the under side of the top trussed rod, which is used as a conduit for the wires. The trussed rod is fastened with a clamp, which permits the turning of the rod so that all the sockets, with the lamps which they carry, can be adjusted to any angle. The curving of the supporting brackets well away from the inner surface of the sign removes them from the line of light so they do not cast a shadow. The height of the plate is 10 in., while the actual height of the letter is 6¼ in. The widest plates are 8 in. for the letters "M" and "W." All other characters, except the letter "I" and punctuations, are 7 in. wide. The narrower plates are 3½ in. wide. Tungsten lamps are used to advantage in these signs.

POSITION INDICATOR FOR GROUP OF ELEVATORS.

The elevator equipments of the new Oliver Building, Pittsburgh; the County and City buildings, Chicago, and the Hotel Sherman, Chicago, include a bank of indicator lamps as shown in the accompanying illustration, placed in view of the starter on the first floor and arranged to light corresponding to the position of the cars at the various floors. The position indicator pictured is that of the 25-story Oliver Building, where there are 14 cars, seven of which run only to the 16th floor. The cord controlling the dial indicators over the various elevator doors, which moves proportionally to the travel of the corresponding car, is attached to a contact brush which moves over a commutator group of contacts, each of which is connected to a lamp behind one of the bullseyes shown. The circuits for all 14 of the cars are cabled to the position indicator, which, by the lighting of the lamps in each row, shows the position of all the cars at a glance. The cabinet is of bronze



Position Indicator for Elevators.

and has the lamps mounted directly on the doors, so that opening these gives free access to the connections. This position indicator is manufactured by the Elevator Supply & Repair Company, Chicago.

PROJECTOR FOR PHOTO-ENGRAVING PURPOSES.

The accompanying illustration shows a projector being manufactured by the Carlisle & Finch Company, Cincinnati, Ohio, for Mr. Burgoyne Jones, of Cincinnati, who perfected the apparatus for photo-engraving use. Owing to the great number of two, three and four-color process prints employed in catalog work, it was found that the old style of arc lamp was too slow for producing results without a great deal of expense, and that it was frequently necessary to make 19 to 24 negatives, which were rephotographed and manipulated in various ways to produce the necessary plates. Mr. Jones, with the aid of the special projector, succeeded in getting results with only three negatives, one for each color, thus cutting down the time to one-tenth that required by the old process. The searchlight consists of a powerful marine projector with a 24-in. parabolic mirror and two sets of dispersion lenses, set cross-wise so as to throw an approximately square beam of light. The secret of the success is said to lie in the quality of glass used in these lenses, which are especially made for this particular purpose. At a distance of 20 ft. the projector throws a beam 12 ft. to 15 ft. square, of an intensity equal to or greater than sunlight, so that a negative can be made in a few seconds.

Projector.

VERTICAL-CARBON FLAME ARC LAMP FOR DIRECT-CURRENT SERIES, MULTIPLE AND MULTIPLE-SERIES SERVICE.

The remarkable efficiency, pleasing appearance, and exceptional quality of light which characterize the flame arc lamp have rendered it pre-eminently adapted for the economic illumination of large areas. Moreover, it is now generally conceded that the flame arc lamp is the most efficient illuminant yet developed, and that the penetrating quality of the brilliant, golden yellow light is such that even under the most adverse atmospheric conditions, such as those imposed by fog or smoke, it provides a highly satisfactory illumination.

A disadvantage of the usual 6.6-amp vertical carbon direct-current flame arc lamp has been the large and wasteful resistance necessary. This new lamp is designed for connecting directly in a 6.6-amp direct-current circuit without any change in the system, simply replacing the other lamps where desired.

Although these lamps are now made for direct-current service only, they find a wide application, being suitable for lighting squares, parks, or special store sections in cities where the 6.6-amp series luminous arc, or the series direct-current enclosed 6.6 amp system, is used for street lighting. They are adapted for multiple and multiple-series service in addition to the above.

The lamps are equipped with a light opal globe and a 26-in. diffuser. The casing, which is of copper with black oxidized finish, is made up in two sections so arranged that, by telescoping the sections, the mechanism is exposed, rendering it unnecessary to remove the entire casing in order to see that the lamp is properly trimmed.

The arc is held in the same position at all times, as the mechanism is of the focusing type. With the exception of this feature, the lamp mechanism is similar to that used in the General Electric standard enclosed lamp, which has given perfect

Vertical Carbon Flame Arc Lamp.

satisfaction during years of service. The lower carbon holder is provided with a ball-and-socket joint to allow perfect alignment of both carbons.

A life of about 20 hours is obtained with one trim when the lamp is adjusted for 6.6 amperes. The design and the materials used are such as to combine attractive appearance, great strength and durability with minimum weight. Particular attention is called to the increased illuminating efficiency obtainable; an average of 2800 mean lower hemispherical candlepower being claimed by the maker.

This increased efficiency, combined with the fact that lamps may be connected directly in the circuit offers the central stations operating direct current an opportunity to take over the lighting of foundries, wharves, etc. The lamp is made by the General Electric Company.

IMPROVED MANHOLE TRANSFORMER.

Distributing transformers as installed in underground vaults, are liable to flooding from heavy rains or overflow water, and consequently one of the main requirements of service is that the manhole transformers shall be water and air tight. Hence, it is necessary to enclose the transformer in a hermetically sealed case, and design it for an exceedingly low

Manhole Transformer.

temperature rise, which conditions imply careful design as well as the highest grade of workmanship. At the same time, the transformer must not only be so constructed that it is possible to make it water-tight, but such that the unit can be installed quickly and easily. Also, it is necessary that the design shall permit the transformer to be connected to or disconnected from the line without removing the cover or otherwise opening the case.

Any expansion of the oil under a rising temperature, of course, compresses the air in the upper portion of the transformer case and causes a rise in pressure. Under abnormal operating conditions, such as a short circuit, a considerable rise in this pressure may occur, which will make the transformer case liable to serious injury. In order to avoid any danger from such occurrences, a safety or relief valve for any excess pressure should be provided. The completed transformers should be tested at the factory at a sufficient air pressure to insure their being air-tight and moisture-proof.

The Westinghouse Electric & Manufacturing Company has designed a transformer to fulfill the foregoing conditions of service, a view of which is given in the accompanying engraving. The magnetic circuits and coils of this transformer are the same as those of the standard Westinghouse type transformer, but they are mounted in a case of special design, that adapts them to manhole service. The illustration shows a transformer supplied by the Westinghouse Electric & Manufacturing Company to the Kentucky Electric Company, Louisville, Ky., one of the largest electrical companies in the country employing underground distribution. The many advantages of this type of construction have led to its adoption for the entire line of transformers designed for manhole service.

Industrial and Commercial News

The Week in Trade.

NOT only is the customary midsummer dullness doing its part to contract trade at the present time, but there is an unusual degree of conservatism which is detracting from the ordinary buying movement. From all parts of the country reports are received that there is a disposition to await further developments in the crop situation before laying in new stocks for fall business. Quite a number of buyers are in the leading markets, but their operations are governed by extremely conservative views. Reports as to the fall trade outlook are rather optimistic in the southwest and in the central West, but in those sections of the country where spring wheat is one of the more considerable crops there is not this feeling of optimism. In some of the smaller cities throughout the West clearance sales did something to stimulate retail trade, but as a rule the retailers report that there was more difficulty in disposing of excess stock this year than there was last year. Weather conditions for the week have not materially changed, and there is still a feeling that too much drought has prevailed both in the western grain belts and in some sections of the cotton district. Corn, as a rule, is in good shape, but in many sections, unless there are rains within the next few days, the process of maturing will be retarded. In the industrial world there is the same tendency to curtail and shade prices that has been observed for the past few weeks. Collections ranged about fair, and reports from the smaller banks of the country indicate that there will be little surplus of cash to carry over slow accounts. Failures for the week which ended July 21, as reported by *Bradstreet's*, were 215 as against 202 the previous week, 239 in the same week of 1909, 263 in 1908, 155 in 1907 and 171 in 1906.

The Copper Market.

COPPER conditions were distinctly improved last week and there was even a fractional advance in the selling price of standard and electrolytic. This improvement is due entirely to well-credited reports which have reached this country from Europe, that a comprehensive "copper understanding" has been almost perfected. It is hardly believed that any merger of the large interests is planned at this time, but the fact that John D. Ryan, president of the Amalgamated; Professor Penrose, of Utah; A. Chester Beatty, of the Gugghenheim Exploration Company; Charles N. McNeill, of the Utah Copper Company, and many English, Scotch and French copper investors had recently been in London together and had been holding meetings, seems to be very significant.

Standard Copper.	Bid.	Asked.	Settling price.
Spot	11.62½	12.00	....
July	11.62½	12.00	11.81¼
August	11.75	12.05	11.90
September	11.85	12.10	11.97½
October	11.90	12.15	12.02½

The London market July 25 was as follows:

	Highest. £	s	d	Lowest. £	s	d
Copper, spot	54	8	9	54	3	9
Copper, futures	55	1	3	54	16	3

Extreme fluctuations for this year:

	Highest.	Lowest.
Standard	13.50c	11.70c
London, spot	£62 0 0	£52 15 0
London, futures	65 18 9	53 7 6
London, best selected	65 10 0	57 15 0

It is even said that J. Pierpont Morgan has been called into consultation, and that he may probably formulate a plan which will reduce the production of copper to the needs of the consumers. It is said that while in Europe Mr. Morgan was in conference with the Rothschilds and the Baron Hirsch interests. There certainly has been some movement in the direction of curtailment in this country. Word has been received from the Butte camp that several thousand men have been laid off, and that a reduction of about 3000 tons of ore per day has been made in the aggregate output. It is believed in Butte that the ultimate curtailment in that section will reach 25 per cent. During the week there were reported some heavy copper sales. Most of this metal was electrolytic which, it is said, averaged about 12½. It was also claimed that several large blocks of electrolytic had been sold for delivery 30 days at 12⅝ cents. Exports for the month have amounted to 18,284 tons, which is much less than the exports for the same month last year. The imports have been heavy, but are hardly up to the average recorded in June. Daily call on the Metal Exchange July 25 quoted standard copper as per the accompanying table.

Industrial and Commercial Notes.

Western Electric Company's Business.—In the issue of July 21 we referred to the fact that the telephone department of the Western Electric Company was being operated overtime, and that the Hawthorne plant had been practically given over to this branch of manufacture. It is given out by the company that this is not, however, the only branch in which increased business is being done. The general sales, it is said, run at a rate which would mean a business of $61,000,000 for the year. This rate compares with $46,000,000 for the year 1909, and is a higher ratio than any business ever done by the company, except in 1906, when the gross sales amounted to $69,000,000. Discussing the situation, an officer of the company said: "The normal rate and the steadiness with which our business is running lead us to believe that the improvement will be maintained. There is nothing like a boom in sight, but on the other hand there is nothing in sight which leads us to think an immediate decline in the business of the country is in order. The foreign business of the company is exceptionally good, but it is without any special feature."

Electrical Jobbers' Association.—The convention of electrical supply dealers of the United States, known as the Electrical Jobbers' Association, was held at Hotel Clifton, Niagara Falls, Ontario, July 19, 20 and 21. The meeting was very largely attended, there being present about 150 supply men and a like number of manufacturers and their representatives. The three days were divided between business and entertainment features, the business meetings being held in the mornings and the afternoons devoted to baseball, automobiling and various other entertainments for the visitors and their lady guests. The next meeting of this association will be held at Hot Springs, Va., in October, and the one to follow that next spring, will be held at Del Monte, Cal. It was decided after some discussion to make this journey to the Pacific Coast in order to bring into closer relationship the various supply men of that section of the United States, several of whom have taken a great deal of interest in the association, and made the journey across the continent to attend conventions.

Insulated Wire Trade.—One of the principal manufacturers of insulated wire reports that the present condition of trade is not at all satisfactory. He says that not only are prices somewhat demoralized, but that the liberal contracts which were anticipated, on account of the considerable amount of building that seemed, early in the spring, to have been planned, have not been realized. There is a disposition, he says, on the part of contractors to use cheaper materials, and this is particularly disadvantageous to those manufacturers who strictly adhere to high-class rubber insulation. According to this manufacturer, the prices made by makers of cheaper grades of insulated wire are below anything that can be quoted by the old line standard manufacturers. This sort of competition has done much to interfere with the trade of some of the principal concerns.

New York Electric Lines Company.—The suit of the New York Electric Lines Company, the wire-leasing concern which is endeavoring to get space in the conduits of the Empire City Subway Company, Ltd., in New York, came up for hearing in the Supreme Court last week and was by mutual consent postponed for hearing until Aug. 2. This mandamus proceeding, which was detailed in full in our issue of July 14, is the entering wedge of the independent telephone interests in New York City. The Great Eastern Telephone Company, which has contracted with the Electric Lines Company for the use of its wires, if space in the conduits is secured, claims to have already more than 100,000 subscribers, under contract, in the downtown district of Manhattan.

Westinghouse Electric Annual Meeting.—The stockholders' meeting on July 27 of the Westinghouse Electric & Manufacturing Company has given rise to much newspaper gossip concerning strained relations between Mr. George Westinghouse and Mr. Robert Mather, chairman of the board of directors. In a statement from his home in Lenox Mr. Westinghouse said that having agreed with the directors last spring to accept a vacation until Aug. 1, so far as official duties of president are concerned, he will not preside at the meeting, nor be present nor represented there. Referring to personal relations, Mr. Westinghouse says that there should have been a constant, proper and considerable recognition of his position as president and of his knowledge and experience gained as the founder and manager of the company, but such has not been the case. On the contrary, he says the chairman within a month after his election embarked upon a course, the inevitable effect of which was to insure the existing deplorable conditions which will make it difficult while he remains president of the company to exercise the duties of an official except when specifically required by the board, and that he naturally opposed the efforts to eliminate him from responsible positions and also, when he thought the interests of the company required, opposed and voted against some of the chairman's recommendations to the board, the carrying out of which he thought would involve loss either in money or prestige. With such an excellent showing of profits for the last two months, he said the assenting stock of the company should now be worth near par, adding that lack of confidence in the management of a company has much to do in making low prices for its securities.

Increase in Rubber Trade.—The United States Rubber Company has unfilled orders on hand at the present time in larger volume than ever before in the history of the company. Up to the present time the sales of the company in its present fiscal year, which began April 1, have averaged about 60 per cent ahead of the same period last year. The Rubber Goods Manufacturing Company, which is controlled by the United States Rubber Company, has also a very large number of orders booked, but its business is not quite up to the standard of the parent company. An official of the United States Rubber Company says that within two or three years the company will begin to get the benefit of its investments in crude rubber plantations in Brazil and Sumatra, and in four or five years should be getting practically all of its entire requirements of crude rubber from its own plantations. The company uses about 20,000,000 lb. of rubber a year, and the ownership of these plantations will make it entirely independent of the crude rubber market. While this official is of the opinion that there will be a very large increase in the general rubber trade within the next five or six years, he does not expect that the price of crude rubber will again reach the high figures of last winter, when up-river Para sold for $3.00 per lb. While very little of this quality of rubber is now used for insulating purposes, the price of Para rubber generally controls the prices of the lower grades.

Susquehanna Transmission Company.—The Susquehanna Transmission Company, which will build the transmission line from the power plant of the Pennsylvania Water & Power Company at McCall Ferry, to Baltimore, has nearly acquired the necessary right of way on which to erect the towers and string the cables. The complete right of way has been secured through York county, Pennsylvania, and Howard county, Maryland, but more difficulty has been experienced in Baltimore county, and condemnation proceedings will be necessary in several instances in the latter county before the acquisition of the entire right of way will have become an accomplished fact. The steel towers on concrete bases, on which the transmission cables are to be strung, have been erected across York county and this work is now going on in the northern part of Howard county. The company is acquiring a strip of land 100 feet wide all of the way from the dam to Baltimore and will fence it in the entire distance, in order that live stock and persons may be less likely to trespass on the right of way.

San Joaquin Light & Power Company.—The properties of the Power, Transit & Light Company, of Bakersfield, Cal., and the Merced Falls Gas & Electric Company, of Merced, Cal., have been purchased by the San Joaquin Light & Power Company, of Fresno, Cal. The latter company is establishing a system for furnishing the oil fields of California with energy, and the plants just purchased will be used for that purpose. The San Joaquin company is now building a hydroelectric plant on the San Joaquin River, where it is expected to develop 20,000 hp. High-tension transmission lines will be constructed from Porterville to Bakersfield, 70 miles, and from Madera to Merced.

Electrical Construction.—Among the items printed under Construction News in our present issue are announcements of proposed new plants or considerable extensions to present plants at Oroville, Wash.; Slater, Mo.; Pittsfield, N. H.; Dalton, Ga.; Frederick, Md.; Wilmington, Del.; Buffalo, N. Y.; Guanacevi, Durango, Mex.; Waddington, N. Y.; Newark, N. J.; St. Petersburg, Fla.; Chelan, Wash.; Wernersville, Pa.; Delta, Col.; Wheeling, W. Va.; Hamburg, Ark.; Norwood, N. Y.; Fulton, N. Y.; Sheridan, Wyo.; Lynchburg, Va.; Edmonton, Alta., Can.; Miles City, Mont.; Lincoln, Ill.; Raleigh, N. C.; Berea, Ohio.; Altoona, Pa.; Cleveland, Ohio, and Devine, Tex.

To Use Steinway Tunnel.—The Long Island Railroad announces that, upon the completion of the electrification work on its North Shore Division, it will establish a station at Hunter's Point Avenue in Long Island City, which will give all passengers coming to New York on any of the divisions a choice of taking the Pennsylvania tunnel or the Steinway tunnel into Manhattan. This will give the passengers using the Long Island Railroad a direct connection with the present subway system at Forty-second Street and Park Avenue

Assessment on Electrical Goods in Warehouse.—The General Electric Company maintains a large warehouse in Chicago for the storage of electrical machinery and supplies. The fact was brought to public notice lately when the Board of Assessors made an assessment of $285,000 on the company in Chicago. A protest was made, however, and the Board of Review reduced the assessment, which was made for the purpose of collecting the personal-property tax, to $170,000.

Attachment Plugs for Panama.—The Isthmian Canal Commission will open bids in Washington, on Aug. 2, for furnishing at the Isthmus of Panama 800 Edison base attachment plugs in four lots designated as items 30, 31, 32 and 33 of zone requisition 4598-A. Details relating to the bids can be ascertained from circular No. 597-A which can be obtained from Captain F. C. Boggs, Corps of Engineers, U. S. Army, General Purchasing Agent, Washington, D. C.

Centralization of Management in Nebraska.—E. A. Bullock, who controls the central stations at Norfolk and York, Neb., and Missouri Valley, Ia., has recently purchased from E. J. Sullivan controlling interest in the Beatrice Electric Company. Mr. Bullock now has an office at 515 Brander's Building, Omaha. Frank McMaster has tendered his resignation as manager of the Beatrice Electric Company.

Easton (Pa.) Gas & Electric Company.—Plans have been completed by the Easton Gas & Electric Company for the installation of an additional 2000-kw turbine unit in its steam power station. A new switchboard will also be installed. H. L. Doherty & Company operate the property.

Allis-Chalmers Turbine Sales.—The Allis-Chalmers Company has sold to the Knight Power Company, of Provo, Utah, two 1650-hp horizontal water turbines operating under a head of 170 ft. These turbines will be regulated by a regulating cylinder operated by penstock pressure.

Equipment for Boston Edison.—The Edison Electric Illuminating Company of Boston has ordered from the General Electric Company a new steam turbo-generator of 15,000 kw capacity. It is expected that the new generator will be delivered next May.

Financial.

THE WEEK IN WALL STREET.

IRREGULARITY and light trading were the features of the Wall Street market last week. During the entire week the Stock Exchange handled less than 3,000,000 shares, and what trading occurred was principally among the professionals. There was very little outside buying, and very little buying by any of those large interests which have heretofore attempted to support the market in its weakest stages. Although the figures for the week show that most of the stocks in which there was any trading at all recorded declines, many people in Wall Street assume to see evidences of a better tone in the market. Many of the best experts declare that the worst of the liquida-

tion is over, and that the holdings of speculators and professional traders have been fairly well sold out; or, in other words, that the bottom has about been reached. All that is needed for a substantial recovery is to develop some buying interest, either inside or outside of the professional ranks. The most startling occurrence of the week was the heavy decline in the common stock of the National Lead Company. When it became known that the dividend on this issue would be reduced from a 5 per cent basis to a 3 per cent basis there was a rush to sell, which carried the stock down more than 20

NEW YORK.

	July 18.	July 25.	Shares sold.		July 18.	July 25.	Shares sold.
All.-Ch.	8½*	8½	100	Int.-Met., pfd.	50½	46½	6,750
All. Ch., pfd.	30*	28	———	Mackay Cos..	84¼	80	300
Amal. Cop...	58¾	58⅜	272,100	Mackay C.,pf.	75*	73*	200
Am. D. T....	20½*	20½*	———	Man. Elev...	128*	128½	504
Am. Loc.....	39	31¼	2,800	Met. St. Ry..	15*	15	———
Am. Loc.,pfd.	107	105	100	N.Y.&N.J.Tel.	139¼*	139¼*	———
Am. Tel. & C.	71½*	71½*	———	Steel, com...	70	64	602,800
Am. T. & T..	132½	131½	5,275	Steel, pfd....	115½	113¼	8,550
B. R. T.....	77	73⅛	20,725	W. U. T.....	61	59½	850
Gen. Elec....	144*	139	1,900	West'h., com.	59*	53	2,100
Int.-Met.	18¼	16	7,210	West'h., pfd..	115*	115*	———

PHILADELPHIA.

	July 18.	July 25.		July 18.	July 25.
Am. Rys.....	42	42*	Phila. Elec.....	14¾	14⅝
Elec. Co. of A.....	11⅝*	11⅝*	Phila. R. T.....	19¼	17
Elec. St. B'ty.....	49½	48	Phila. Trac.....	84½*	82½*
E. S. B'ty, pfd.....	30*	30*	Union Trac.....	45*	42⅝

CHICAGO.

	July 18.	July 25.		July 18.	July 25.
Chi. City Ry.....	180*	180*	Chi. Tel. Co.....	118	118*
Chi. Rs., Ser. 1.....	70*	70*	Met. El. Co.....	20*	20
Chi. Rs., Ser. 2.....	15¾	15*	Met. El., pfd.....	62½*	60*
Com. Edison.....	112	109¾	Nat'l Carbon.....	115	115*
Chi. Subways.....	2¼*	2½	Nat'l Car., pfd.....	118*	115

BOSTON.

	July 18.	July 25.		July 18.	July 25.
Am. T. & T.....	132¾	131¾	Mex. Tel.....	5¼*	5¼
Cum. Tel.....	141	141*	Mex. Tel., pfd.....	6½*	6¼*
Edison E., Ill.....	255	255	N. E. Tel.....	133	132¼
Gen. Elec.....	142*	139¾	W. T. & T.....	16	15¾*
Mass. E. Ry.....	14¾*	14½	W. T. & T., pfd....	86	86
Mass. E. Ry., pfd...	79	79*			

* Last price quoted.
Shares sold for four days, July 18 to July 23.

points in a few days. The decline in the price of this issue has been almost 50 per cent since the first of the year. Although there was little gain in prices, the copper stocks were, as a rule, a trifle stronger on the reports that definite arrangements were being made to curtail production. It has been generally recognized for many months that, unless something was done in this direction, dividends could not be earned very much longer on Amalgamated and some of the other heavily capitalized corporations. In the money market there was a little buying of bonds developed, but they were in very small lots and it was generally understood that the purchasing was done by small investors who were putting their July dividends back into securities. While the money market continues to be very easy, the banks were somewhat astonished, and considerable gossip was originated, by the suggestion from Secretary of the Treasury MacVeagh, that national currency associations be formed in order that in time of need the banks might more easily issue the emergency currency provided for in the Aldrich-Vreeland law. The necessity for such issue seems so far away from the present conditions of the money market that the suggestion was rather startling. Quotations for money remain easy, and on July 25 were: Call, 1½ @ 2¼ per cent; 90 days, 4 per cent. The quotations in the table are those of the close, July 25.

Financial Notes.

American Telephone & Telegraph Company.—The report of the American Telephone & Telegraph Company for the first six months of 1910 shows a substantial improvement in total earnings over the corresponding period of last year. From time to time it has been pointed out in these columns that the monthly earnings of the company were exceeding those of the corresponding month in 1909. From the preliminary figures of the half year's report, it now appears that the total earnings of the company for the six months expanded more than $2,300,000, while net earnings showed an increase of nearly $2,000,000. The fact that the company's gross revenues were about $17,595,000, and that the net profits were almost $16,000,000, shows that the property is operated on an extremely conservative and economical basis. Last year the company's total earnings, including dividends, interest, traffic and other receipts, amounted to almost $33,000,000, or about $5,000,000 more than in the previous year. In view of the fact that the total earnings for the first half of the year 1910 were more than $17,500,000, it is evident that the record for the year will show practically as good an increase as the record for 1909. The net income available for dividends for the first six months of 1910 was equal to 5.12 per cent on the present $259,694,200 capital stock outstanding. This is at the rate of 10.24 per cent for the year, and indicates that after the regular 8 per cent dividend has been paid there will be a material surplus carried over.

National Lead Company.—Within the past week there has been a serious slump on the New York Stock Exchange in the price of the common stock of the National Lead Company. This is largely due to the fact that at the meeting of the directors last week the company declared a dividend of ¾ of 1 per cent, payable Oct. 1. This stock has heretofore been paying dividends at the rate of 5 per cent per annum. At the first of the year the common stock of the National Lead Company sold for about 90; last week it touched the low point of 47. President L. A. Cole, of the company, says that the reduction of the dividend on the common stock was made necessary by the diminishing trade of the company. This he holds to be due, to some extent, to the high price of linseed oil, which price he believes will be permanently high, and which tends to diminish the amount of lead products used. The profits of the company have been reduced, and Mr. Cole anticipates a lesser net revenue. It is said that this reduction in the dividend of the National Lead Company will have no effect upon the affairs of the American Smelting & Refining Company. While both of these companies are controlled by the same interests, their inter-relations are not intimate. The American Smelting & Refining Company sells pig lead to the National company, but it does not handle its ores nor has it any stock ownership or stock control.

Washington, Baltimore & Annapolis.—It was reported last week that the Washington, Baltimore & Annapolis Electric Line would be in a position to pay six months' interest on the $2,145,000 issue of the 5 per cent terminal bonds on Sept. 1, amounting to something over $51,000. The company met the interest for the quarter ending June 1. The company is making a good record from an earning standpoint. The report for June was issued last week and shows an excellent increase over 1909. Gross earnings were $53,818, as compared with $49,063 for the same month of last year, making an increase of 9.69 per cent. The statement places the net earnings at $24,576, as against $14,503 for 1909, or a percentage increase of 69 per cent. For the fiscal year ending June 30 the gross earnings were $638,114, operating expenses $365,601, and net earnings $272.512.

Electric Consolidation in Louisville.—The joint committees on gas and water of the boards of Aldermen and Councilmen of the city of Louisville have been hearing arguments upon the proposed consolidation of the Louisville Gas Company, which owns the Louisville Lighting Company, with the Kentucky Electric Company. Details of this consolidation have not yet been worked out, as it is necessary for the city authorities to sanction the merger and issue a new franchise. Under the law, any new franchise will have to be advertised and sold to the highest bidder, and until the consolidated company has purchased such a franchise it would be impossible to determine the necessary capitalization of the new company. At the present time there is active competition between the two companies in the business section of the city.

American Power & Light Company.—The American Power & Light Company, the new holding concern organized last month to take over the properties of the Northwest Corporation located in Idaho and Oregon, details of which were given in our issue of June 16, has purchased the hydroelectric plant and distributing system of the Wasco Warehouse Milling Company, of The Dalles, Ore. The plant consists of a hydroelectric station on White River and transmission lines to Dufur and The Dalles, Ore. The energy is used for lighting and power, including the operation of the large flour mills of the Wasco company.

Stromberg-Carlson Telephone Manufacturing Company.—F. N. Kondolf, president of the Stromberg-Carlson Telephone Manufacturing Company, of Rochester, has just submitted to his stockholders a report of the business of the company for the first six months of 1910. This shows a net profit for the period, after deducting $45,241, for maintenance and renewals, of $70,158 as compared with $33,536 in the previous six months. The total surplus of the company on June 30 was $240,593. The company has outstanding $3,000,000 stock equally divided between preferred and common.

Michigan State Telephone Company.—Announcement has been made by N. W. Harris & Company, bankers, of New York, that they have sold their interest in the Michigan State Telephone Company to the American Telephone & Telegraph Company. The bankers owned the majority of the common stock of the company. The Michigan company has an authorized issue of $4,000,000, 6 per cent cumulative preferred, and $6,000,00 common stock. There is outstanding $2,285,000 preferred and $3,500,000 common. According to the terms of the purchase, four shares of the stock of the American Telephone & Telegraph Company are to be exchanged for five shares of common stock of the Michigan State Company. The minority stockholders will be given an opportunity to exchange their holdings on the same basis. The Michigan company was incorporated in 1904, and was the successor of the Michigan Telephone Company. The company in 1909 leased the property of the Northeastern Telephone Company, which operates in fifteen counties in Michigan. The number of telephones the company had in use, according to a report dated Dec. 31, 1909, was 132,270.

United Light & Railways Company.—Announcement has been made of the merger of eight public service corporations in Indiana, Iowa, Michigan, Tennessee and Illinois under the name of the United Light & Railways Company. The holding concern will have a capital stock of $30,000,000. The companies included are: The Laporte (Ind.) Electric Company, the Laporte Gaslight Company, the Cedar Rapids (Ia.) Gaslight Company, the Fort Dodge (Ia.) Light Company, the Muscatine (Ia.) Light & Traction Company, the Cadillac (Mich.) Gaslight Company, the Mattoon (Ill.) Gaslight Company and the Chattanooga (Tenn.) Gas Company. The new company will take over the holdings of the Childs-Hulswit syndicate of Grand Rapids, which owns the controlling interest in the public service corporations named above. It is said that other properties will probably be secured in the near future. The gross earnings of the eight companies taken over were last year $861,600.

Federal Telephone & Telegraph Company.—The Federal Telephone & Telegraph Company, of Buffalo, has certified to the Secretary of State of New York that it has merged the following telephone companies, of which it owned all of the capital stock: Corning, Watkins, Ithaca, Springfield, Marilla, Canisteo, Wellsville, Hornellsville telephone companies; Conewango, Valley Home, Cohocton Valley telephone and telegraph companies; Elma Telephone Exchange; Citizens Telephone Company of Bath, Attica Home Telephone Company, Citizens Telephone Company, of Akron, N. Y., and the Valley Telephone Company. The certificate is signed by Bert G. Hubbell, president of the Federal Telephone & Telegraph Company. This company operates under Bell patents in Buffalo and the surrounding territory.

Foxboro (Mass.) Electric Company.—The Foxboro Electric Company has applied to the Massachusetts Gas & Electric Commission for permission to increase its capital stock from $16,500 to $60,000. The demands upon the plant have outgrown its capacity and the proceeds of the new issue are to be used for extensions and improvements.

Laclede Gaslight Company.—The report of earnings for the first six months of 1910 of the Laclede Gaslight Company, of St. Louis, shows that the company is earning a trifle more than 9 per cent on the $8,500,000 outstanding common stock. The actual amount available for dividends on this stock at the end of the six months' period was $383,499.

DIVIDENDS.

Amalgamated Copper Company, quarterly, ½ of one per cent, payable Aug. 29.

Cambridge (Mass.) Electric Light Company, quarterly, 2½ per cent, payable Aug. 1.

Connecticut Railway & Lighting Company, quarterly, preferred and common, each 1 per cent, both payable Aug. 15.

Jacksonville (Fla.) Electric Company, semi-annual preferred, 3 per cent; common, 3½ per cent, payable Aug. 1.

Montreal Light, Heat & Power Company, quarterly, 1¾ per cent, payable Aug. 15.

National Carbon Company, quarterly, preferred, 1¾ per cent, payable Aug. 15.

Ohio Traction Company, preferred, quarterly, 1¼ per cent, payable Aug. 1.

United States Motor Company, preferred quarterly, 1¾ per cent, payable July 30.

West Penn Railway Company, preferred, quarterly, 1¼ per cent, payable Aug. 1.

Western Telephone & Telegraph Company, preferred, semi-annual, 2½ per cent, payable Aug. 1.

REPORTS OF EARNINGS.

	Gross earnings.	Expenses.	Net earnings.	Charges.	Surplus.
American Light & Traction Company:					
June, 1910	$286,209	$12,047	$274,161	.....	.....
June, 1909	238,171	9,649	228,522	.....	.....
Baton Rouge Electric Company:					
May, 1910	8,936	6,127	2,809	1,938	871
May, 1909	8,193	6,657	1,536	1,141	*395
Cape Breton Electric Company, Ltd.:					
May, 1910	21,575	12,379	9,196	5,038	4,158
May, 1909	18,744	11,671	7,073	5,036	2,037
Houghton County (Mich.) Electric Light Company:					
May, 1910	19,621	10,904	8,717	4,334	4,383
May, 1909	17,908	10,529	7,379	4,129	3,250
Keystone Telephone Company, Philadelphia:					
June, 1910	97,990	45,307	52,683	.....	.....
June, 1909	93,051	44,653	48,398	.....	.....
Kings County Electric Light & Power Company:					
June, 1910	352,906	172,712	180,194	103,672	76,522
June, 1909	304,270	149,036	155,234	87,810	67,424
Laclede Gas Light Company:					
Six months ended June 30, 1910	2,234,908	1,192,635	1,042,273	559,855	383,499
Six months ended June 30, 1909	2,036,906	1,126,021	910,885	562,559	294,958
Lowell (Mass.) Electric Light Corporation:					
May, 1910	32,847	20,359	12,488	4,634	7,854
May, 1909	26,810	16,640	10,170	4,197	5,973
Montreal Street Railway Company:					
June, 1910	384,564	198,848	185,715	59,053	126,662
June, 1909	354,918	187,320	167,597	51,134	116,463
Niagara Lockport & Ontario Power Company:					
June, 1910	45,526	18,262	27,264	20,721	7,953
June, 1909	32,922	16,433	16,489	20,832	*2,891
Northern Texas Electric Company:					
May, 1910	117,765	64,483	53,282	19,722	33,560
May, 1909	104,899	57,947	46,952	17,189	29,763
Ontario Power Company, of Niagara Falls:					
June, 1910	55,853	11,209	44,643	47,375	3,677
June, 1909	46,079	87,234	*41,155	26,724	*62,702
Paducah (Ky.) Traction & Light Company:					
May, 1910	19,329	11,748	7,581	6,987	594
May, 1909	17,698	10,418	7,280	7,027	253
Philadelphia Company:					
June, 1910	1,681,633	944,406	737,227	.....	.....
June, 1909	1,378,449	857,372	421,077	.....	.....
Puget Sound Electric Railway Company:					
May, 1910	169,190	105,837	63,353	50,679	12,674
May, 1909	156,053	108,065	47,988	47,831	157
Seattle Electric Company:					
May, 1910	467,961	273,934	194,027	105,736	88,291
May, 1909	457,258	274,459	182,799	103,315	79,484
Southern New England Telephone Company:					
Year, 1910	2,473,346	1,926,944	546,402	461,622	84,780
Year, 1909	2,264,775	1,725,885	538,890	461,605	77,285
United Railways of St. Louis:					
June, 1910	996,808	662,385	334,423	232,897	104,194
June, 1909	960,964	600,617	360,347	232,320	131,085

*Deficit.

General News

Construction News.

BOAZ, ALA.—It is reported that T. W. Carroway, of Gadsden, Ala., is interested in a project to establish an electric light and power plant in Boaz.

OPELIKA, ALA.—At an election held July 15 the proposition to issue $85,000 in bonds for the construction of an electric light plant and water works system was carried.

SAFFORD, ARIZ.—The Pacific Gas & Electric Company, of Los Angeles, Cal., is reported to be contemplating the installation of an electric light and power plant in Safford, Ariz.

HAMBURG, ARK.—The Board of Commissioners of the Hamburg District has selected a site for the proposed water and light plant. The lot was donated by J. M. Parker, general manager of the Arkansas, Louisiana & Gulf Railway Company. Work will commence at once on construction of the plant, and it is expected to have it in operation within 90 days.

NASHVILLE, ARK.—The J. C. Stephenson Lumber Company, of Nashville, Ark., is reported to have been granted a franchise to supply electricity for lamps in Nashville.

ALHAMBRA, CAL.—The Board of Trade of Alhambra has recommended that the City Trustees call an election to vote on the proposition to issue $75,000 in bonds for the purpose of erecting a municipal distributing system. It is proposed to purchase electricity to operate the system. It is understood that the City of Pasadena, which operates a municipal plant, has offered to furnish the service at a low rate. The Home Telephone Company, of Alhambra, has offered the use of its poles to the city, free of charge, for a term of years.

ECHO, CAL.—The Board of Supervisors has sold to the Mount Whitney Power Company a 50-year franchise to erect transmission lines over certain highways in Kern County for the distribution of electricity for lamps and motors. The amount paid for the franchise was $50.

EMERYVILLE, CAL.—Application has been made to the Board of Trustees of the Town of Emeryville by the Great Western Power Company for a franchise to erect transmission lines for the distribution of electricity for lamps and motors in Emeryville. Bids will be received by the Board of Trustees until Aug. 15 for the above franchise. F. H. Farr is town clerk.

FRESNO, CAL.—The San Joaquin Light & Power Company has purchased the properties of the Power, Transit & Light Company, of Bakersfield, Cal., and the Merced Falls Gas & Electric Company, of Merced, Cal. The new plants will be the basis of the system by which the company will supply Kern, Midway and Maricopa oil fields with electricity for the operation of oil wells. It is proposed to erect a high-tension line from the vicinity of Porterville to Bakersfield, a distance of 70 miles. At present a second transmission line is being erected from Madera to Merced to furnish electricity in Merced. The San Joaquin Light & Power Company is now erecting a large dam, 125 ft. in height on the San Joaquin River, which will develop about 20,000 hp.

GROVELAND, CAL.—Arrangements are being made by Manager Graham, of the Gold Ship mines, to install an electric power plant at once and to erect a mill to crush the cement gravel.

LOS ANGELES, CAL.—Preparations are being made by the Pacific Electric Railway Company to secure the right of way for an electric railway between Rose Hill and Lincoln Park, a distance of two and one-half miles. The cost of the proposed railway is estimated at about $100,000.

OAKLAND, CAL.—Bids will be received by the Board of Public Works, Oakland, Cal., until Aug. 19, for furnishing electrical equipment for the new building for the Fire Alarm and Police Telegraph Department, of the City of Oakland, now under construction at Oak and Thirteenth Streets. Frank R. Thompson is clerk of the Council.

PORTERVILLE, CAL.—Work has commenced on construction of the proposed electric railway to connect Porterville, Tulare, Poplar, Woodville, Springville and Globe, 87 miles in length. H. H. Holley is interested in the project.

RIVERSIDE, CAL.—Plans are being considered by H. E. Koebig, Sr., and associates for extensive developments of water power and for impounding water for irrigation purposes, both in Strawberry Creek and the south fork of San Jacinto River. Applications for rights of way, building permits and other privileges in the national forest reserve have been granted by the United States Government. The work includes the erection of a large dam across Strawberry Creek at the lower end of the Domenigoul ranch. Notice of appropriation of water to be taken from the south fork of the San Jacinto River has been filed by the same parties; the water to be used exclusively for power purposes. The power plant is to be located at a point in the south fork near the junction of Strawberry Creek.

SACRAMENTO, CAL.—The Pacific Gas & Electric Company was awarded the contract for furnishing electricity for lighting East Sacramento, Folsom and Oak Park. The company will furnish 2000-cp arc lamps in East Sacramento and Oak Park at the rate of $6.30 each per month, the same as paid in Sacramento; in Folsom, where 40-watt lamps are used instead of arc lamps, a flat rate of $75 a month or $900 a year will be charged. The electors of Curtis Oaks have asked the Board of Supervisors for permission to call an election to vote on the proposition to form a special lighting district in Curtis Oaks.

SAN BERNARDINO, CAL.—The City Council is considering the question of calling an election to vote on the proposition to issue bonds for the construction of a municipal electric light plant. The city now pays $12,000 annually for street lighting, and when the next contract is awarded and 100 or more lamps installed it is expected that the cost will be about $20,000 per year.

SAN FRANCISCO, CAL.—Plans are being considered for an extension of the Jackson Street car line through the western part of the Presidio reservation out to Fort Point.

DELTA, COL.—The Delta Electric Light Company is contemplating the installation of a 100 or 200-kw generating unit and a boiler in its plant, and establishing a day service next spring. J. E. Shue is treasurer and manager.

LAS ANIMAS, COL.—Plans are being prepared by the Colorado Telephone Company for improvements to its systems in Las Animas, Lamar and Holly, and other plants in the Arkansas Valley. A new cable plant will be installed in Las Animas, at a cost of $8,000; the improvements at Lamar and Holly will cost about $16,000.

KILLINGLY, CONN.—Preparations are being made by the Attawaugan Company to equip its mill for electrical operation. A contract has been placed by the company for a 700-hp engine which will be connected to a generator.

NEW HAVEN, CONN.—Proposals will be received at the office of the Board of Education, 87 Orange Street, New Haven, Conn., until July 30 for wiring and lighting the New Haven High School, for equipment for domestic science and manual training rooms at Prince Street School, and for new engine and generator at the Boardman Manual Training School in this city. Bids will be received for each building separately. Specifications and forms of proposal may be obtained at the above office. G. T. Hewlett is secretary of Board of Education.

TORRINGTON, CONN.—The Torrington Electric Light Company has submitted a proposition to the Borough Board in relation to improving the present street lighting system. The company offers to replace the present 25-cp incandescent lamps with 80-cp tungsten lamps for $32 per lamp per year. At present there are about 354 electric street lamps, the cost of which is estimated at about $8,500 per year. The new system would increase the cost from $4,000 to $5,000. The lamps will be lighted every night until midnight, but after that hour the moonlight schedule will be followed. The present contract calls for moonlight schedule.

WILMINGTON, DEL.—It is reported that the Wilmington Malleable Iron Company, of Wilmington, Del., will increase the output of its power plant by the installation of two generators with a rating of about 700 hp and an additional boiler. The company is now building an addition to the power house.

WASHINGTON, D. C.—Bids will be received at the office of the chief signal officer, War Department, Washington, D. C., until Aug. 5, under proposal No. 471, for furnishing two transformers, one with a rating of 10 kw and the other of 3 kw. A. S. Cowan is disbursing officer.

WASHINGTON, D. C.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Aug. 19, for furnishing and installing lighting fixtures in the United States buildings at Gonzales, Tex.; Greenwood, S. C.; Michigan City, Ind.; Paris, Ky.; Pittsfield, Mass.; Augusta, Maine, and Eureka, Cal., in accordance with drawings and specifications, copies of which can be obtained at the above office. James Knox Taylor is supervising architect.

WASHINGTON, D. C.—The last session of Congress voted appropriations for construction, extensions and improvements of power plants, electrical equipment, etc., for public buildings, etc., for the year ending June 13, 1911, as follows: For the installation of electrical burglar devices in post office, court house at Chicago, Ill., and post office and subtreasury building at Boston, Mass., $30,000; for purchase and installation of an underground electric transmission system at Proving Ground, Sandy Hook, N. J., $6,500; for rearrangement and addition to power plant, including the erection of new power house, at Watertown Arsenal, Watertown, Mass., $55,700; for repairs of Interior Department and Pension buildings and of old Post Office Department building, Washington, D. C., including the preservation and repair of steam heating and electric lighting plants and elevators, $20,000; for installation of electric elevators in the pension office building and changes in building, $15,000; for construction and installation of electric light, power and telephone cables between the city of Galveston, Tex., and the immigrant station on "Pelican Spit," $5,000, and for equipping with motors four 6-in. lathes used in small gun shop, $2,900.

ST. PETERSBURG, FLA.—The St. Petersburg Investment Company is planning to install two 250-hp Berry boilers and a tungsten series street lighting system. H. Walter Fuller is manager.

TAMPA, FLA.—Mayor McKay is reported to have recommended a bond issue for municipal ownership of the lighting plants.

WHITE SPRINGS, FLA.—The City Council is considering the question of calling an election to vote on the proposition to issue $45,000 in bonds, the proceeds to be used for the construction of an electric light plant, water-works and sewerage system. The city recently voted against issuing bonds to the amount of $20,000 for water-works and sewerage systems. G. S. Mobley is Mayor.

DALTON, GA.—Plans and specifications have been completed by H. S. Jaudon Engineering Company, of Savannah, Ga., for electric light plant and water-works. The electric plant will be combined with the water-works plant. The electrical equipment will include noncondensing engines direct-connected to generators, with a rating of 500 hp. The equipment of the pumping plant will consist of a steam pump and an electric pump for pumping water from Mill Creek into settling basin. Filter tanks, etc., will be located at this station. Two steam pumps and one electric pump will pump the water after it has been filtered into the reservoir on top of Mount Rachel.

JACKSON, GA.—The Middle Georgia & Interurban Railway Company has received permission from the State Railroad Commission to issue $100,000 in capital stock and $50,000 in bonds. The company proposes to construct and operate an electric railway between Jackson and Griffin, Ga.

VALDOSTA, GA.—The Consolidated Light & Power Company has applied to the State Railroad Commission for permission to issue $50,000 in capital stock and $75,000 in bonds, the proceeds to be used for the construction of an electric light and power plant in Valdosta, Ga. The company also proposes to operate an electric light plant in conjunction with the generating plant.

BOISE, IDAHO.—The Snake River Irrigation Company is reported to have awarded contracts for the construction of dam, power house and retaining wall for the Castle Butte project, located on the Snake River about 38 miles south of Boise. The cost of the work is estimated at more than $500,000. E. C. Crocker is vice-president.

LEWISTON, IDAHO.—The Lewiston-Clarkson Investment Company is reported to have entered into a contract with the Washington Power Company, of Spokane, Wash., for electricity to be delivered at Moscow, Idaho, on a new transmission line to be erected from Palouse to Moscow, there to connect with the Lewiston system.

CARTERVILLE, ILL.—The Egyptian Traction Company, which proposes to construct an electric railway to connect Mt. Vernon, Ind., and Murphysboro, Ill., 100 miles in length, has been granted franchises for a term of 50 years in the cities of Carterville and Carbondale. The company will also ask for franchises in Marion, Crainville and Dorrisville. T. E. Hixon, of Eldorado, Ill., is general manager.

CHICAGO, ILL.—Bids will be received by the City of Chicago, 705 City Hall Building, Chicago, Ill., for furnishing and installing switchboard complete for the new City Hall, according to plans and specifications on file in the office of the Department of Public Works, City Hall. Proposals must be on blanks furnished by the above office. B. J. Mullaney is commissioner of public works.

DECATUR, ILL.—Preparations are being made by the City of Decatur for the construction of an entire new municipal electric light plant, bids for which are now being asked. Bonds to the amount of $75,000 were voted for the purpose. J. J. Miller is chief electrician.

DECATUR, ILL.—A meeting of the stockholders of the Decatur Southern Traction Company will be held Aug. 31 to vote on the proposition to increase the capital stock of the company from $25,000 to $1,500,000 and to mortgage its property to secure an issue of bonds. H. C. Simmons, of Virden, Ill., is secretary.

LINCOLN, ILL.—Plans are being considered by the Lincoln Water & Light Company to increase the output of its plant by the installation of alternating-current, 60-cycle generators in the near future. E. McDonald is superintendent.

PANA, ILL.—The City Council has granted the Decatur Southern Traction Railway Company a franchise to construct an electric railway in Pana. The proposed railway will connect Decatur, Macon, Assumption and Pana. R. McCalman, of Decatur, Ill., is chief engineer.

PORT BRYON, ILL.—Surveys have been completed by the Tri-City & Northeastern Interurban Railway Company for its proposed electric railway between Albany and Morrison. Work will soon commence on construction of the railway, which is to connect Watertown, Port Byron, Cordova and Albany. J. W. Simonson, of Port Byron, Ill., is president.

SANDOVAL, ILL.—The installation of a municipal electric light plant in Sandoval, at a cost of about $10,000, is reported to be under consideration.

SOUTH HOLLAND, ILL.—The Eastern Illinois Railway Company has applied to the Village Board for a franchise to construct an electric railway in South Holland, Ill. The company is a subsidiary of the Consolidated Railways Company, of Chicago, Ill.

CORYDON, IND.—Frank R. Wright, owner of the Corydon Light, Water & Ice Company, is in the market for a second-hand, 100-kw, direct-connected unit, which must be in good order.

DALEVILLE, IND.—A company has been organized by the citizens of Daleville for the purpose of installing an electric light plant.

GAS CITY, IND.—The Marion Light & Heating Company is reported to have applied for a franchise in Gas City, Ind., to erect transmission lines to supply electricity to manufacturing plants in this city.

MIDDLETOWN, IND.—A special election will be held to vote on the proposition of establishing a municipal electric light plant or to place a contract with a private company as in the past. The cost of installing a new plant is estimated at $28,000. The town owns its water plant and the sentiment is strong for the installation of an electric plant.

NEW ALBANY, IND.—Edward H. Hartley, of New Albany, Ind., is interested in a project to organize a company for the purpose of supplying gas and electricity in New Albany. The company, it is said, will furnish street lamps at the rate of $50 per lamp per year and gas at 80 cents per 1000 cu. ft., which is a reduction of 20 per cent on the present rates.

POCAHONTAS, IA.—The city is contemplating the construction of an electric light plant, to cost from $12,000 to $14,000, bids for which will be asked for in the near future. George Schneider is city clerk.

HERINGTON, KAN.—We are informed that the Water and Light Department of the City of Herington is negotiating with the City of Hope to supply electricity in that city. A transmission line eight miles in length will be erected, and 50 kw will be supplied at 10,000 volts. C. E. Stromquist is superintendent of the municipal water and light plant.

PARSONS, KAN.—The City Commission is considering a resolution calling for a special election to vote on the proposition to issue $40,000 in bonds for the construction of a municipal electric light plant.

WICHITA, KAN.—The contract for the construction of the new power house of the Kansas Gas & Electric Company has been awarded to the Deiter & Wenzel Construction Company, of Wichita, Kan. The cost of the entire plant is estimated at about $787,000. The cost of the building is $112,000; the equipment $341,000; for line construction in the city $50,000. The remainder will be used for repairs and distribution of lamps, etc. Contracts have already been placed for equipment of the plant.

WICHITA, KAN.—The Arkansas Valley Interurban Railway Company has graded 15 miles of its proposed 30-mile railway between Wichita and Newton, Kan., which later will be extended to Hutchinson, Kan., 55 miles from Wichita. Electricity for operating the railway will be purchased from the Kansas Gas & Electric Company, of Wichita, Kan., at 33,000 volts. The cars will enter the business center of Wichita over the tracks of the Wichita Railroad & Light Company. W. O. Van Arsdale is president of the company and O. A. Boyle, vice-president and general manager.

NEW ORLEANS, LA.—The committee of the Sewerage and Water Board on drainage has submitted the report of the advisory board of engineers for drainage with an estimate of cost. It is estimated that about $5,500,000 will be available for construction purposes during the next four or five years. The board of advisory engineers recommends that approximately $2,257,000 be expended in lined and covered canals; for wood-lined subchannels, $1,034,000, and for additional power and equipment, total cost $1,410,000—water purification stations and pumping stations 1, 6, 2, 7, 3 and 5. The first item is for utilizing the surplus boiler power and room at the water purification station for generating electricity, from which transmission lines are to lead to pumping stations number 1 and 6, forming a loop into which both the central power station and the additional machinery at the water purification station will feed, thereby greatly enhancing the efficiency of the service and minimizing the possibility of accident.

DEXTER, MAINE.—Announcement has been made by the Dexter Electric Company that a 24-hour service will be established as soon as improvements have been completed to its power plant. A new generator is being installed in the power station. It is expected to have the work completed by Aug. 15.

BALTIMORE, MD.—The Baltimore County Commissioners have granted the United Railways & Electric Company a franchise to extend its Monument street line to Orangeville.

BEL-AIR, MD.—At a meeting of the stockholders of the Bel-Air Electric Company an amendment to its charter was accepted, giving it the right to condemn property along Winter's Run. The company also approved of an issue of $25,000 in bonds. The company is building an auxiliary plant on Winter's Run, about three miles below the main plant.

ELKTON, MD.—At a special election held in Elkton recently the proposition to issue $75,000 in bonds, the proceeds to be used for the construction of a municipal electric light plant and water-works system and for extensions to sewerage system, was defeated.

FREDERICK, MD.—P. O. Keilholtz, Continental Building, Baltimore, Md., has been engaged by the Frederick Railroad Company and the Hagerstown Railway Company to prepare plans for the construction of a power house to be used jointly by both companies.

BOSTON, MASS.—The contract for installing electrical equipment in the addition to the Girl's High School has been awarded to Alfred J. Hixon.

BOSTON, MASS.—Sealed bids will be received at the office of the auditor of the school committee, Room 53, 168 Tremont Street, Boston, Mass., for furnishing and delivering (within one year from date from acceptance of the bid), at such school buildings as the auditor of the

school committee may designate, high-efficiency, metallic filament lamps in accordance with the following schedule: 5435-25-watt, clear; 202-40-watt, frosted; 50-60-watt, frosted, and three 100-watt, frosted. William J. Porter is auditor.

FOXBORO, MASS.—The Foxboro Electric Company has petitioned the State Board of Gas and Electric Light Commissioners for permission to increase its capital stock from $16,500 to $65,000, the proceeds to be used for extensions and improvements to its plant.

MARLBORO, MASS.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Aug. 25 for the construction, complete, including plumbing, gas piping, heating apparatus, electric conduits and wiring, of the United States post office at Marlboro, Mass., in accordance with plans and specifications, copies of which can be obtained from custodian of site at Marlboro, Mass., or at the above office. James Knox Taylor is supervising architect.

BAY CITY, MICH.—Negotiations between the Tittabawassee Power Company and the City Council have been brought to an end owing to the failure of the latter to authorize the Mayor and Comptroller to enter into a contract with the company. The City Council recently voted to enter into a contract with the Tittabawassee Power Company to supply electricity to operate the municipal electric light plant at the rate of 8 mills per kw-hour on the basis of a minimum of 500 kw per hour.

BRONSON, MICH.—The city is reported to be considering the purchase of the local electric light plant and installing a water-works system.

DETROIT, MICH.—It is reported that work will soon commence on the new structural steel shop and office building of the Henry B. Lewis Structural Iron Works, of Detroit, Mich. The building will be 115 ft. x 200 ft., and will be equipped with an electric traveling crane.

SAGINAW, MICH.—Orders have been placed by the Marquette Motor Company, of Saginaw, Mich., with the Allis-Chalmers Company, of Milwaukee, Wis., for two 100-kva, 4600-115-volt and three 150 kva, 4600-460-volt, oil-filled, self-cooled transformers, which will be used for the distribution of electricity for lamps and motors about the works.

HIBBING, MINN.—The Mesaba Telephone Company is making extensive improvements to its system in Hibbing. All open wires will be replaced by cables. A new toll line is being erected between Swan River and Grand Rapids.

PELICAN RAPIDS, MINN.—The contract for furnishing machinery, equipment, etc., for changes and additions to the municipal electric light plant has been awarded to the Power Engineering Company, of Minneapolis, Minn., for $4,521. H. N. Bruce is village recorder.

KANSAS CITY, MO.—The Inter City Viaduct Company, which owns the toll viaduct between Kansas City, Mo., and Kansas City, Kan., has applied to the City Council for a franchise to extend its switching system in the north and wholesale and manufacturing district and over viaducts in the west bottoms. The switching is to be done by electric locomotives.

ST. JOSEPH, MO.—The St. Joseph & Savannah Railway Company has awarded the contract for the construction of its proposed railway between St. Joseph and Savannah, a distance of 15 miles, to the J. H. Flick Construction Company, of Chicago, Ill. John H. Van Brunt, of St. Joseph, Mo., is president.

SLATER, MO.—Sealed proposals will be received at the office of J. A. Stern, city clerk, until Aug. 9 for furnishing material and labor for extension of water-works system and electric light plant as follows: (1)—For furnishing material and labor (except as outlined in subsequent items) for extending water-works and electric light systems. (2)—For construction of reservoir. (3)—For furnishing generators, switchboard and transformers, f.o.b. Slater, Mo. (4)—For furnishing two high-speed engines for 60 and 100-kw generators, f.o.b. Slater, Mo. (5)—For furnishing boiler and feed pumps, f.o.b. Slater, Mo. (6)—For furnishing material and erecting chimney. Plans and specifications are on file at the office of the city clerk and at the office of Burns & McDonnell, engineers, Scarritt Building, Kansas City, Mo. Extra copies of the plans may be secured of the engineers upon payment of $5 to cover cost of same. John T. Rector is Mayor.

CULBERTSON, MONT.—The installation of an electric plant in Culbertson is under consideration.

LIBBY, MONT.—At a mass meeting held recently favorable action was taken on the application of George H. Stanton, C. C. Proctor and E. K. Barnum for a franchise to construct an electric light plant and water works system in Libby. It is expected that the Council will take favorable action on the franchises.

MILES CITY, MONT.—Sealed proposals will be received at the office of J. E. Farnum, city clerk, until Aug. 22, for furnishing materials and constructing extensions and improvements to the electric light and water works systems for the city of Miles City, Mont., for which separate bids will be received as follows: (1) For furnishing all material and constructing main and outfall sewer, sewage pumping and disposal plants; (2) for furnishing certain materials and constructing intake and reinforced concrete settling basin, filter chambers, etc.; (3) for hauling and laying cast-iron pipe and setting hydrants and valves; (4) for furnishing material and constructing power house; (5) for furnishing all cast-iron and fittings, f.o.b., Miles City, Mont.; (6) for furnishing all hydrants and valves, f.o.b., Miles City, Mont.; (7) for furnishing and erecting steel tower and tank of 200,000 gal. capacity, all at an elevation of not less than 100 ft., and furnishing and erecting a steel chimney and breeching, chimney to be 72 in. in diameter and 100 ft. high; (8) for furnishing all equipment and installing mechanical filter plant of four units, each having a capacity of 500,000 gal. per day; (9) for furnishing all pumping machinery, consisting of six turbines and centrifugal type, motor driven units, and two steam-driven air compressors; (10) for furnishing f.o.b. Miles City, and supervising the erection of one fully equipped air lift system for sewage pumping; (11) for furnishing one 200-kw, 60-cycle, three-phase, 2300-volt generator, one 50-hp motor and two 15-kw exciters f.o.b Miles City; (12) for furnishing and erecting one 250-hp Corliss engine; (13) for furnishing all power station switchboard equipment. Plans and specifications are on file at the office of the city clerk and at the office of Burns & McDonnell, engineers, Scarritt Building, Kansas City, Mo. A complete set of plans may be secured upon payment of $15 on application to the engineers; Section 1 and 2, $10 each; 3, 4 and 8, $2 each; for 5, 6, 7, 9, 10, 11, 12 and 13 no charge will be made. Specifications covering Sections 10, 11 and 12 may be obtained from the Superintendent of the Water and Light Department, Miles City, Mont.

BEATRICE, NEB.—E. A. Bullock, 515 Brandeis Building, Omaha, Neb., who controls the central stations at Norfolk and York, Neb., and Mission Valley, Ia., has recently purchased the controlling interest in the Beatrice Electric Company from E. J. Sullivan.

MILFORD, NEB.—Owing to inability to sell its bonds, the city of Milford has postponed the letting of contracts for the construction of the proposed electric light plant and water-works system. Plans were prepared by Martz Brothers, of Seward, Neb.

PITTSFIELD, N. H.—The Pittsfield Light & Power Company has recently been organized to construct an electric light plant in Pittsfield, N. H. The company has entered into a contract with the town for street lighting for a term of five years. C. F. Gardner, of Raymond, N. H., is treasurer and general manager of the company and will have charge of installing the plant, which will be driven by steam power. F. W. Hutchins, of Pittsfield, N. H., is president, and George H. Colbath, of Pittsfield, N. H., is secretary.

BURLINGTON, N. J.—The City Council has passed over the Mayor's veto the ordinance granting the syndicate which purchased the property of the Burlington Electric Light & Power Company a 50-year franchise in Burlington.

JERSEY CITY, N. J.—Plans have been prepared by McLaughlin Brothers, 521 St. James Street, Philadelphia, Pa., for the construction of a machine shop for James Craig, to be erected on Garfield Avenue, Jersey City, N. J. The building will be equipped with electric traveling crane and machinery for the construction of engines. McLaughlin Brothers will have charge of construction and installation of equipment of the entire plant.

NEWARK, N. J.—Sealed proposals will be received by the Committee on Public Buildings of the Board of Freeholders, Essex County Court House, Newark, N. J., until Aug. 5 for the installation of an electric light and power plant at the Essex County Court House, Newark, N. J., in accordance with plans and specifications prepared by Runyon & Carey, consulting engineers, 122 Market Street, Newark, N. J., where copies of plans and specifications and blank proposal forms may be secured. Louis E. Voorhees is chairman of public buildings committee.

LAS CRUCES, N. M.—Application has been made to the City Council by the Las Cruces Light & Power Company for a franchise to construct an electric light plant and water works system in Las Cruces. H. B. Holt is interested in the company.

AUBURN, N. Y.—Announcement has been made by the George Junior Republic of a gift from John D. Rockefeller and V. Everett Macy, of New York, N. Y., of funds to install an electric light plant in the little republic, the minimum cost to be $7,500.

BOONVILLE, N. Y.—We are informed that bids will not be asked for the construction of the concrete dam to be built in connection with the municipal electric plant; the work will be done by the day. The cost of the work is estimated at about $25,000. W. G. Stone, of Utica, N. Y., is engineer in charge.

BUFFALO, N. Y.—Bids are being received by the Board of Supervisors, City and County Hall, Buffalo, N. Y., for the construction of an electric light and power plant for the Erie County Penitentiary. The power house will be 60 ft. x 65 ft., built of stone, brick and steel.

CATSKILL, N. Y.—The Catskill Traction Company is planning to extend its railway from the Greene County Agriculture Society's Fair Grounds, at Cairo, westward along the Susquehanna Turnpike to Oak Hill, a distance of 12 miles. W. C. Wood is president.

FRIENDSHIP, N. Y.—The Friendship Telephone Company, of Allegheny County has increased its capital stock from $7,500 to $1,000,000. The company proposes to extend its telephone lines throughout the United States.

FULTON, N. Y.—The Victoria Paper Company, which is planning to enlarge and remodel its paper mill, is reported to be contemplating the installation of gas-producer units with a rating of 1500 hp for driving its plant.

GAROGA, N. Y.—Contracts have been awarded by the Garoga Water Power & Transmission Company for the construction of hydroelectric plants on Peck Lake and Garoga Lake, N. Y., including power house, to the Empire Engineering Corporation, 60 Wall Street, New York, N. Y. The plans call for the development of 20,000 hp.

GLOVERSVILLE, N. Y.—Plans are being made by the Fulton County Gas & Electric Company for the construction of a high-tension transmis-

sion line from Gloversville to Ephrata, a distance of nine miles. The proposed line will require 135 steel towers. A brick substation 60 x 33 ft. will be built.

JAMESTOWN, N. Y.—We are informed that the Jamestown Lighting & Power Company is erecting a substation in Jamestown. The company will purchase electricity from the Jamestown Street Railway Company. It is expected to have the station completed and in operation by Sept. 15. Albert S. Price is secretary and treasurer.

NEW YORK, N. Y.—Bids will be received until Aug. 3 by F. A. Neely, secretary State Armory Board, State Capitol, Albany, for electric wiring and fixtures in State Arsenal, Seventh Avenue and Thirty-fifth Street, New York, N. Y. Plans and specifications may be seen and blank forms of proposals obtained at the above office and at the State Arsenal, New York, N. Y.

NIAGARA FALLS, N. Y.—The Ontario Power Company has just completed its new penstock, 1⅛ miles in length and 18 in. in diameter, at a cost of about $500,000. The company is now concentrating all efforts on completion of its power house.

NIAGARA FALLS, N. Y.—Preparations are being made by the National Lead & Battery Company, of Niagara Falls, N. Y., for the construction of a large addition to its plant on Elizabeth Street, in the Niagara Power Land Company manufacturing district. The company manufactures storage batteries, etc. D. M. Hepburn, of Niagara Falls, N. Y., is manager.

NORWOOD, N. Y.—Plans are being prepared by the Norwood Paper Company for the construction of a 4000-hp hydroelectric plant. The work will include the construction of a large concrete dam and flume. B. Cleveland, of Watertown, N. Y., is engineer.

OLEAN, N. Y.—The Olean Electric Light & Power Company has been authorized by the Public Service Commission, Second District, to increase its capital stock from $35,000 to $85,000, the proceeds to be used to pay for indebtedness incurred in making additions and improvements to its plants.

SCOTIA, N. Y.—It is reported that plans are being considered for the construction of municipal electric and gas plants in Scotia, N. Y.

WADDINGTON, N. Y.—Preparations are being made by the New York & Ontario Power Company to begin work on the construction of its proposed hydroelectric generating plant at Waddington, on the St. Lawrence River, which, it is expected, will be under way by October. The cost of the plant is estimated at $5,000,000, and about 50,000 hp will be developed.

CHARLOTTE, N. C.—Surveys have been completed by the Isothermal Traction Company for its proposed interurban railway from Asheville to Rutherford, which constitutes the first division. Work will soon commence on the survey of the second division, from Rutherford to Asheville, through the heart of the Appalachians. The company proposes to construct an interurban electric railway, 100 miles in length, from Gastonia to Asheville, via Mt. Holly and other cotton mill towns.

HICKORY, N. C.—It is reported that plans are being considered for the manufacture of a new electric iron-ore smelting furnace in Hickory, electricity for which is to be supplied by the Thornton Light & Power Company. The new process is attributed to a Canadian inventor, who is said to be negotiating with the power company for power service and other facilities for manufacturing the new smelters. It is estimated that $750,000 would be required to complete the plant for the above purpose.

RALEIGH, N. C.—The Carolina Power & Light Company is reported to have submitted a proposition to the Board of Aldermen, offering to replace the present street lamps with magnetite lamps at an increased cost of $800 per year. The company, it is said, proposes to install a new street lighting system at a cost of about $200,000.

GRAND FORKS, N. D.—The name of the Grand Forks Gas & Electric Company, the holdings of which were recently purchased by H. M. Byllesby & Company, of Chicago, Ill., has been changed to the Red River Power Company. Extensive improvements will be made to the system this season, involving an expenditure of about $100,000. They will include the installation of a 750-kw, engine-driven generator, the construction of from 20 to 25 miles of electric transmission line for the distribution of electricity in the residence districts and the construction of nearly four miles of new 4-inch gas mains. In the past there has been practically no electrical service in the residential districts in Grand Forks. The Red River Power Company has announced a substantial reduction in the rates for electrical and gas service.

BEREA, OHIO.—It is reported that plans are being considered for improvements to the municipal electric light plant, for which bonds to the amount of $16,000 have been voted.

CINCINNATI, OHIO.—The Cincinnati, Portsmouth, Pomeroy & Pittsburgh Electric Railway Company is reported to have completed preliminary arrangements for construction of its proposed electric railway from Cincinnati, Ohio, to Pittsburgh, Pa., along the Ohio River Valley, work on which, it is said, will begin within 60 days. A. E. Cox, of Huntington, W. Va., president.

CINCINNATI, OHIO.—Sealed bids will be received by the Board of Hospital Commissioners, City Hall, Cincinnati, Ohio, until Aug. 9, for furnishing all material and installing lighting fixtures, inter-communicating telephone system, vacuum cleaning system, laundry machinery, etc., required for the completion of the present building for the contagious group of the New General Hospital, located at Eden and Bethseda avenues, Cincinnati, Ohio, in accordance with plans and specifications, which are on file at the office of the architects, Samuel Hannaford & Sons, Sixth and Vine streets, Cincinnati, Ohio.

CLEVELAND, OHIO.—The power plant of the Flushing mine of the Kennon Coal & Mining Company, of Cleveland, was destroyed by fire recently. The equipment of the plant consisted of three boilers, one generator and engine. The loss is estimated at from $10,000 to $20,000.

CLEVELAND, OHIO.—We are informed that the Cleveland Southwestern & Columbus Railway Company expects to purchase stokers for a 3275-hp power house, located in Elyria, in the near future; also coal and ash-handling machinery. E. F. Schneider, of Cleveland, Ohio, is general manager.

ARDMORE, OKLA.—It is reported that Messrs. Cravens & Mort, of Milton, Ia., and Patterson & Moore, of Enid, Okla., are negotiating for the purchase of the property of the Ardmore Traction Company, which is in the hands of C. L. Byrne as receiver.

DURANT, OKLA.—The installation of a municipal electric light plant is reported to be under consideration.

FOSS, OKLA.—The City Council is reported to be considering the question of installing an electric light system in Foss.

VINITA, OKLA.—The Vinita Electric Light, Ice and Power Company is contemplating changing its system from single to three-phase about Sept. 1. C. E. Lahman is secretary and manager.

ASHLAND, ORE.—Application has been made to the City Council by John R. Allen, representing the Southern Oregon Railway & Power Company to construct an electric railway in Ashland, Ore. The company proposes to build a railway through the Rogue River Valley and Southern Oregon.

ROSEBURG, ORE.—J. L. & S. A. Kendall, owners of the hydroelectric plant at Roseburg, Ore., have purchased a 20 x 36 "Reliance" type, heavy duty engine from the Allis-Chalmers Company, of Milwaukee, Wis., which will be belted to the generator to operate the plant during the low-water period. The plant at present is equipped with a turbine connected to a 200-kw, 60-cycle, three-phase, 6600-volt alternator.

ST. JOHNS, ORE.—The Portland Railway, Light & Power Company has been granted a franchise by the City Council to construct and operate an electric railway over certain streets in St. Johns.

THE DALLES, ORE.—The American Light & Power Company, recently organized to take over properties of the Northwest Corporation in Idaho and Oregon, has purchased the hydroelectric plant and distributing system of the Wasco Warehouse Milling Company, of The Dalles, Ore.

ALTOONA, PA.—The Pennsylvania Central Light & Power Company is reported to be preparing plans for the construction of an electric light and power plant in Altoona, Pa.

BERWICK, PA.—Preparations are being made by the Berwick & Nescopeck Street Railway Company, of Berwick, Pa., for the construction of from four to eight miles of track, contracts for which, it is expected, will be awarded during the next 30 days. A. C. Sickels, of Berwick, Pa., is president.

BRADFORD, PA.—Proposals will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Aug. 29, for the construction complete, including plumbing, gas piping, heating apparatus, electric conduits and wiring, of the United States post office in Bradford, Pa., in acordance with drawing and specifications, copies of which may be obtained from the custodian of site at Bradford, Pa., or at above office. James Knox Taylor is supervising architect.

CHESTER, PA.—It is reported that plans are being considered by the Chester Traction Company for extensive improvements to its system in Chester and throughout the county, including the double-tracking of its railway between Wilmington and Darby.

ERIE, PA.—The contract for construction of power house and laundry building to be erected at Second and State streets, Erie, Pa., for the Hamet Hospital, including boilers, conduits and laundry equipment, has been awarded to the Henry Schenk Company, of Erie, Pa. D. N. Dennis is president; Esenwein & Johnson, 781 Ellicott Square, Buffalo, N. Y., are architects.

MERCERSBURG, PA.—The contract for erecting the power house in connection with the Mercersburg Academy has been awarded to C. W. Strayer, of Harrisburg, Pa., for $6,900. George A. Woods is a member of the building committee.

PHILADELPHIA, PA.—The Philadelphia Rapid Transit Company, it is said, will apply for a franchise to extend its railway from Chester Avenue, Yeadon, to the Sixty-ninth Street terminal.

PHILADELPHIA, PA.—The contract for installing power plant equipment at the navy yard, Philadelphia, Pa., has been awarded to the D'Olier Engineering Company, of Philadelphia, Pa., for $15,421.

PHILADELPHIA, PA.—The Autocar Company, of Ardmore, Pa., is reported to be in the market for a gas engine with a rating of 30 or 40 hp, direct-connected to generator to supply electricity for 300 lamps in a car garage which it is now erecting at Twenty-third and Market Streets, Philadelphia, Pa.

PITTSBURGH, PA.—Contracts have been placed by the Morris & Bailey Steel Company with the Allegheny County Light Company to furnish electricity for lamps and motors for its cold rolling mill at Wilson Station. The contract calls for 400 kw.

PITTSBURGH, PA.—Bids will be received at the office of the city

controller until Aug. 1 for rewiring the administration building, nursery and bakery and remodeling plumbing and sanitary system of the Women's Home and Hospital for the Department of Charities, Marshalsea station, Pittsburgh, Chicago, Cincinnati and St. Louis Railroad. Plans, specifications and proposals can be secured at the office of John P. Brennan, assistant superintendent of the bureau of building inspection, corner of Sixth Avenue and Cherry Alley, for which a deposit of $10 will be required for each set. E. R. Walters is director of Department of Charities.

SOMERSET, PA.—The Somerset Telephone Company has filed a notice of increase in capital stock with the Secretary of State of from $60,000 to $200,000.

WERNERSVILLE, PA.—Plans are being made for enlarging the electric light plant at State Hospital for the Insane, at Wernersville, Pa., the cost of which is estimated at about $15,000.

CHARLESTON, S. C.—It is reported that a special committee has been appointed by Mayor R. H. Rhett to engage engineers to make investigations and estimate of cost of construction of a municipal electric light plant in Charleston, S. C.

LEXINGTON, S. C.—It is reported that Dreher Shoals have been purchased by James U. Jackson, of Augusta, Ga., and associates, who propose to develop the same and construct a hydroelectric power plant.

DEADWOOD, S. D.—The Consolidated Power & Light Company, of Deadwood, S. D., is in the market for an electrically operated pump that will automatically keep the water pressure in a building above that of the city main which supplies the water, without the aid of a tank placed in the building. Morgan M. Maghee is assistant manager.

PIERRE, S. D.—The South Dakota Interurban Railway Company has filed amendments to its charter increasing its capital stock from $1,000,000 to $2,000,000 and changing its western terminal to Chamberlain on the Missouri River, instead of Bijou Hills. As yet the promotors have done no active work on the proposed railway, but have been securing the rights of way and doing other preliminary work.

DECHERD, TENN.—It is reported that contracts have been awarded by the city for the construction of an electric light plant and waterworks system.

LEXINGTON, TENN.—Application is reported to have been made by C. P. Wilson to the City Council for a franchise to construct and operate an electric light plant in Lexington, Tenn.

BASTROP, TEX.—The installation of a Corliss engine and an ice plant is contemplated by the Bastrop Water & Light Company. W. B. Ransome is president and manager.

BRYAN, TEX.—A proposition has been submitted to the City Council offering to construct water, sewerage and electric light systems in Bryan, to cost from $75,000 to $100,000. When completed they are to be turned over to the city and a vender's lien note on the same retained by the owner, payable in 10 years. It is understood that the Council favors the proposition.

DEVINE, TEX.—Messrs. Burnett & Fennemen, of Indianapolis, Ind., have submitted a proposition to the town offering to install an electric light plant and an ice factory in Devine. The town, it is said, will furnish a site, free of charge, for the proposed plants. It is stated that the electric plant will be completed and in operation within 90 days.

ELGIN, TEX.—The plant and holdings of the Elgin Automatic Telephone Company have been sold by U. P. Culp, receiver, to Mrs. W. H. Rivers for a consideration of $6,500. It is understood that the new owner will make improvements to the system.

EL PASO, TEX.—The Allis-Chalmers Company, of Milwaukee, Wis., has recently received an order from the Southwestern Portland Cement Company, of El Paso, Tex., for an 8-in. centrifugal pump direct connected to an induction motor. Electricity for operating the motor will be transmitted 1½ miles. The pump will deliver about 2000 gal. per minute against a head of 80 ft. to a reservoir which supplies the plant.

GOLIAD, TEX.—The plant and holdings of the Goliad Water & Light Company are reported to have been purchased by E. Glaze, of San Antonio, Tex. The new owner, it is said, proposes to make improvements to the systems.

GREENVILLE, TEX.—At an election held recently the proposition to grant S. A. Price, of Dayton, Ohio, and associates a 50-year franchise to construct and operate an electric street railway in Greenville was carried. Preparations are now being made by the promoters to begin work on construction of the railway at an early date.

TEMPLE, TEX.—The bondholders of the Belton & Temple Traction Company, who recently purchased the property at a receiver's sale, have taken over the property. Preparations are being made by the new owners for extensive improvements to the property and to extend the system into several new residence parts of the city. W. G. Haag was receiver for the company.

FARMINGTON, UTAH.—Preparations are being made by the Home County Telephone & Electric Company for extending its transmission line from Hooper to Plain City, a distance of about 12 miles. The company has a power plant in the Farmington Canyon and supplies electricity in Farmington and Hooper.

GUNNISON, UTAH.—The Gunnison Valley Power Company, which is developing its water power site, has recently placed an order with the Allis-Chalmers Company, of Milwaukee, Wis., for equipment for its plant, including a 540-hp, single horizontal turbine with cast-iron spiral, operating under a head of 210 ft., direct connected to a 300-kva, 2300-volt, 60-cycle, three-phase, 450-r.p.m. alternator; a 10-kw exciter will be direct connected to an extension of the main shaft. Three 100-kva, oil-filled, self-cooled transformers will be used to step up voltage for transmission.

PRICE, UTAH.—The injunction against the City of Price, which was filed by Frank Grosse, restraining it from building an electric light plant on one of the side streets, has been sustained by Judge A. H. Christenson. This action will make it necessary for the city to secure another location for its power house.

PROVO, UTAH.—The Allis-Chalmers Company, of Milwaukee, Wis., has recently received an order from the Knight Power Company, of Provo, Utah, for two 1650-hp, 514 r.p.m., single horizontal turbines operating under a head of 170 ft. The turbines will be regulated by a regulating cylinder operated by the penstock pressure, which can also be controlled electrically from the switchboard or mechanically from the turbine. In case of emergency a direct mechanical gear can be placed in operation.

LYNCHBURG, VA.—Bids will be received by the special board of the Virginia State Epileptic Colony until Aug. 1 for the following work on the site of the Colony in Amherst County, near Lynchburg, as follows: (1) For a complete heating system, boiler, power and lighting plant, etc. (2) For 4-in. pipe line connecting the colony with the water main of the City of Lynchburg, about 5,000 ft. in length. Dr. A. S. Priddy is executive officer of the Virginia Epileptic Colony.

PORTSMOUTH, VA.—It is reported that a movement has been started by the business men of Middle Street, between High and King streets, for the installation of an ornamental street-lighting system.

BELLINGHAM, WASH.—Application has been made to the City Council by the Bellingham-Skagit Railway Company for a franchise to construct and operate an electric railway in Bellingham. If granted the company agrees to have the road completed by July 1, 1911.

CHELAN, WASH.—Plans are being considered by Brown & Company, of Chelan, Wash., for the construction of a new 5000-hp hydroelectric power plant. George D. Brown is president and general manager.

NORTH YAKIMA, WASH.—The Pacific Power & Light Company has applied to the Commissioners of Yakima County for a franchise to erect transmission lines over Grandview addition and Second Avenue addition to Sunnyside. Another franchise is also asked to construct a line north from Sunnyside to transmit electricity for irrigating purposes.

OROVILLE, WASH.—The North Washington Power Company has leased the plant and distributing system of the Similkameen Power Company, of Oroville, Wash., for a term of 10 years. Preparations are being made by the North Washington Power Company to begin work immediately on the erection of a transmission line across the country to transmit electricity into the Republic camp. It is expected that the output of the plant will be increased to meet the demands of the increasing service.

TACOMA, WASH.—The contract for the construction of the head work and tunnel in connection with the municipal electric plant on the Nisqually River, has been assigned by Wright, Sweeney & Cummings, to George Milton Savage and W. E. Nichols, for $655,255. The cost of the entire plant is estimated at $2,000,000.

WILSON CREEK, WASH.—The City Council has granted C. J. Wellar a 50-year franchise to operate an electric light and power plant in Wilson Creek.

WHEELING, W. VA.—Plans are being prepared by Sargent & Lundy, engineers, of Chicago, Ill., for the new power plant to be erected by the Consumers' Electrical Company in Wheeling, W. Va., at a cost of about $700,000.

MANITOWOC, WIS.—The Electric Company, of Manitowoc, Wis., has commenced work on the reconstruction of its entire system. The present equipment, consisting of three steam and one gas engines, driving eight bi-polar and three multi-polar generators, which have been in use over 20 years, will be replaced by a new boiler plant, condensing steam turbine plant and three-phase, 60-cycle, 2300-volt distributing system. Frank P. Woy, consulting engineer, of Madison, Wis., will have charge of the work.

OSHKOSH, WIS.—The E. B. Hayes Machine Company, of Oshkosh, Wis., is reported to have under consideration the construction of a new building 60 ft. x 250 ft., with a wing 30 ft. x 80 ft., which will be used as a power house, blacksmith shop, etc. The main building will be equipped with an electric traveling crane.

PULASKI, WIS.—The Pulaski Merchants' & Farmers' Telephone Company has increased its capital stock from $5,000 to $10,000.

WASHBURN, WIS.—The Washburn Electric Light & Power Company has changed its system to 60-cycle, 15,000-1100-110-volt, and established a day service. A new substation having an output of 150 kw has been erected. Electricity for operating the system is purchased from the Ashland Light, Power & Street Railway Company, of Ashland, Wis. M. A. Sprague is president of the Washburn Electric Light & Power Company.

BASIN, WYO.—The city has purchased the plant and holdings of the Wyoming Light & Power Company, for a consideration of $18.000. The plant will be owned and operated by the municipality.

SHERIDAN, WYO.—The Federal Light & Traction Company, which recently took over the property of the Sheridan Electric Light & Power Company, is contemplating the construction of a power plant on Tongue River and developing 4000 hp at a cost of about $150,000.

EDMONTON, ALTA., CAN.—It is reported that negotiations have practically been completed whereby the Edmonton Heat & Power Com-

pany, Ltd., will supply the City of Edmonton with electrical power to the amount of 10,000 hp to operate the municipal electric plant at the rate of $20 per hp per year. The present plans of the company call for the construction of a new hydroelectric plant at Rocky Rapids, 125 miles up the Saskatchewan River, work on which will be started at once. About 36,000 hp will be developed. The transmission line will be about 60 miles in length.

MEDICINE HAT, ALTA., CAN.—A by-law appropriating $50,000 for the construction of an electric light and power plant will be submitted to the ratepayers on Aug. 15. A. K. Grimmer is city engineer.

NEW WESTMINSTER, B. C., CAN.—It is reported that plans are being considered by the Canada Power Company, of Stave Falls, for erecting a transmission line from Stave Falls to Pitt River for the purpose of supplying electricity to the towns of Haney, Hammond and other villages.

WARDNER, B. C., CAN.—The Bull River Falls Mining & Power Company has changed its name to the Bull River Electric Power Company, Ltd., and increased its capital stock from $1,000,000 to $2,000,000. The company is erecting a 12,600-hp hydroelectric power plant. G. E. Henderson is president and manager.

WINNIPEG, MAN., CAN.—Sealed tenders will be received by the chairman of the Board of Control, Winnipeg, Man., Can., until Sept. 1, for furnishing and installing 46,000 ft. of 13,000-volt, three-core cable. Copies of specifications and form of tender may be obtained at the office of the power engineer, Carnegie Library Building, Winnipeg, Man., and also at the offices of Smith, Kerry & Chace, Confederation Life Building, Toronto, Can. M. Peterson is secretary.

BEAVERTON, ONT., CAN.—The Beaverton Electric Light & Power Company is erecting three transmission lines, two miles in length, and will furnish electricity for one 50-hp, one 15-hp and one 10-hp motor. The company will also supply electricity for lighting Ethel Park, Beaverton, where about 300 lamps are used. James Dobson is owner and manager.

SEAFORTH, ONT., CAN.—A by-law will be submitted to the ratepayers on Aug. 8 authorizing the town to enter into an agreement with the Hydroelectric Power Commission to supply electricity to the amount of 400 hp and to appropriate $25,000 for the installation of an electrical distribution system.

TORONTO, ONT., CAN.—Contracts have been awarded by the University of Toronto for the construction of the power house, tunnels and part of the machinery in connection with the new central heating plant to L. K. Comstock & Company, of New York, N. Y.; for boilers to the Babcock & Wilcox Company, of Montreal, Que., Can.; to W. J. McGuire, Ltd., of Toronto, Ont., Can., for heating mains; the total aggregating $250,000. Darling & Pearson, of Toronto, Ont., Can., are the architects.

GUANACEVI, DURANGO, MEX.—We are informed that J. E. Knotts, of Guanacevi, Mex., is contemplating the installation of a 50 or 75-kw, three-phase, 2200-volt, 60-cycle generator connected to engine in his mill for the purpose of furnishing electricity for lamps and motors in the City of Guanacevi. About three miles of transmission line will be erected, and a street-lighting system installed.

NEUVO LAREDO, MEX.—The electric street railway system of this city, owned and operated by F. E. Scoville, of Laredo, Tex., was placed in operation July 17. Electricity for operating the system is furnished from the plant of the Laredo Electric & Railway Company, of Laredo, Tex.

New Industrial Companies.

THE ALLIANCE DEVELOPMENT COMPANY, of Olean, N. Y., has been granted a charter with a capital stock of $25,000 for the purpose of doing a general electrical business. The incorporators are: Alfred Tothill, Edward M. Tothill and Peter J. Messer, of Olean, N. Y.

THE AURORA MANTLE AND LAMP COMPANY, of Dover, Del., has been chartered with a capital stock of $145,000 by J. Arthur Corrodus, of Llanerch, Pa.; Charles B. Downs, of Philadelphia, Pa., and James M. Shatterfield, of Dover, Del.

THE BAIRD ELECTRIC COMPANY, of Chicago, Ill., has been chartered with a capital stock of $5,000 for the purpose of manufacturing electrical apparatus. The incorporators are: George C. Dent, F. A. Campbell, E. P. Baird, all of Chicago, Ill.

THE BROWN-SMITH BATTERY COMPANY, of Bloomington, Ind., has been incorporated with a capital stock of $25,000 by Charles L. Rawles, Fletcher Gardner, M. E. Showers, J. E. P. Holland, Phillip Hill and L. V. Van Buskirk. The company proposes to manufacture electrical supplies, storage batteries, motors, dynamos and all materials connected with batteries and electrical apparatus.

THE COMO ELECTRICAL COMPANY, of Como, Monmouth County, N. J., has been chartered with a capital stock of $50,000 by William W. Rowan, of Asbury Park, N. J.; Thomas Hinckley, of Spring Lake, N. J., and William E. Anderson, of Englishtown, N. J. The company proposes to manufacture mechanical and electrical devices.

THE DELAWARE ELECTRICAL SUPPLY COMPANY, of Dover, Del., has been incorporated with a capital stock of $10,000 by Harry L. Richardson, of Laurel, Del.; John T. Evans, of Laurel, Del., and William T. Shockley, of Dover, Del.

THE DUNKIRK ELECTRICAL MANUFACTURING COMPANY, of Dunkirk, N. Y., has been organized by Albert W. Cummings, Harry T. Litchfield, Owen B. Mulholland, Charles J. Carney and John Lechner. The company is capitalized at $100,000 and proposes to do a general electrical business.

THE HUGHES ELECTRIC COMPANY, of Chicago, Ill., has filed articles of incorporation with a capital stock of $50,000 for the purpose of manufacturing electric specialties. The incorporators are: George T. Hunes, T. M. Craven, F. A. Cothan and E. H. Williams, all of Chicago, Ill.

THE JACOBS ENGINEERING COMPANY, of Ottawa, Ill., has been chartered with a capital stock of $30,000 by W. F. Jacobs, Charles C. Jacobs and W. C. MacFarlane. The company proposes to do a general engineering and contracting business.

THE LOVELACE AEROPLANE & MOTOR COMPANY, of New York, N. Y., has been incorporated with a capital stock of $25,000 for the purposes of manufacturing and selling motors, engines, self-propelling vehicles, etc. The incorporators are: H. Amerman, F. W. Marshall, of New York, N. Y., and E. M. Morrison, of Brooklyn, N. Y.

THE NATIONAL ELECTRIC ENAMELING COMPANY, of New York, N. Y., has been incorporated by Merritt H. Rice, Charles Edmund Harvey and Francis A. Woodward, of New Rochelle, N. Y. The company is capitalized at $200,000 and proposes to manufacture brick, tiles, earthenware, etc.

THE NIELSON-FLEMING ENGINEERING & CONSTRUCTION COMPANY, of New York, N. Y., has been chartered by G. S. Fulton, of New Rochelle, N. Y.; W. A. Stevens, of Garden City, N. Y., and G. Stockman, of New York, N. Y. The company is capitalized at $100,000 and proposes to do a general engineering and contracting business.

THE PARAGON SELLERS COMPANY, of Chicago, Ill., has been incorporated by Edward N. Piatt, Ralph E. MacDuff and Elbert E. Dewey. The company is capitalized at $20,000 and proposes to manufacture electrical specialties.

THE RAILWAY IMPROVEMENT COMPANY, of New York, N. Y., has been incorporated with a capital stock of $100,000 by R. L. MacDuffie, G. W. Fairchild and A. H. Carlisle, of New York, N. Y. The company proposes to do general contracting and electrical work of all kinds; also to do a general electrical and mechanical engineering business.

THE SAYLOR GENERATOR GRATE & STOKER COMPANY, of Boston, Mass., has been incorporated with a capital stock of $100,000 for the purpose of manufacturing and selling furnaces, boilers, etc. The incorporators are: Franklin G. Saylor, of Quincy, Mass., president; Charles W. Adams, of Quincy, Mass., treasurer, and John A. Phelan, of Quincy, Mass., clerk.

THE SIMMS MAGNETO COMPANY, of New York, N. Y., has filed articles of incorporation with a capital stock of $1,000,000 for the purpose of manufacturing magnetos. The incorporators are: Victor D. Hecht, Horace M. Kelbarn, Alfred Nathan, Charles S. Guggenheimer and Mortimer Stiefel, all of New York.

THE WIRELESS MUSIC COMPANY, of Chicago, Ill., has been incorporated by Walter J. Merritt, John Cochinsky, August Knickels and M. M. Ashton, 8 Borden Block, Chicago, Ill. The company is capitalized at $2,500 and proposes to transmit sounds by wireless system.

New Incorporations.

MORRILTON, ARK.—The Morrilton Light & Power Company has been incorporated with a capital stock of $20,000 by William L. Moose, Clifton Moose and C. H. Burr. The company proposes to generate and sell electricity.

WILMINGTON, DEL.—The Interstate Light & Power Company has filed articles of incorporation with the Secretary of State with a capital stock of $3,000,000. The incorporators are: William J. Maloney, Millard C. Taylor and E. Buterworth Davis, all of Wilmington, Del.

WYOMING, DEL.—The Kent Water, Light & Power Company has been chartered with a capital stock of $25,000 by Hugh T. Downing, Webster N. Haas, and Harry T. Shelley, all of Philadelphia, Pa.

OCALA, FLA.—The Marion County Telephone Company has been incorporated with a capital stock of $10,000 to operate a telephone line from Citra to Ocala, Lake Weir and Leesburg.

CALDWELL, IDAHO.—The Homestead Rural Telephone Company has been incorporated with a capital stock of $5,000 by W. H. Davis, A. W. Smith and others.

BLOOMINGTON, ILL.—Articles of incorporation have been filed by the Kinloch-Bloomington Telephone Company with a capital stock of $500,000. John T. Lillard is president and H. F. Farwell is secretary of the company.

COLLINSVILLE, ILL.—The Collinsville Electric Company has been incorporated with a capital stock of $100,000 by J. J. Frey, A. W. Crawford, E. B. Hess and Jacob J. Frey, of Hillsboro, Ill. The company proposes to operate gas, electric and water plants.

DECATUR, ILL.—The Macon County Telephone Company has been incorporated with a capital stock of $150,000 to operate a telephone system. The incorporators are: J. W. Collins, W. E. Surface and A. V. Brownback.

ELGIN, ILL.—The Elgin Traction Company has been incorporated with a capital stock of $100,000 by George S. Webb, William T. Angell and W. D. Bell. The company proposes to construct an electric railway in Elgin.

SEYMOUR, IND.—The Jennings & Jackson County Rural Telephone Company has been incorporated with a capital stock of $3,000 by Michael Hunt, William Kessler, Jacob Noll. Clayton Downs, Frank Hill and Fred Neihouse. The company proposes to construct and operate a telephone system in Jennings and Jackson Counties with principal office in Seymour.

SEYMOUR, IND.—Articles of incorporation have been filed for the Chestnut Ridge & Farmington Telephone Company, by Albert Ahlbrand, William Booth, B. F. McIntyre, John F. Albering, George Nuss and A. A. Ruddick. The company is capitalized at $3,000 and proposes to construct and operate a telephone exchange in Farmington and extend its lines throughout Jackson County.

KANSAS CITY, MO.—The Big Niangua Hydroelectric Company has been chartered with a capital stock of $150,000 by R. E. Bremer, P. M. Bremer and H. M. Bremer.

ST. LOUIS, MO.—The McKanna Interurban Company has been organized with a capital stock of $500,000 to construct an interurban electric railway from St. Louis, Mo., to Oklahoma City, Okla., via Ada, Roff and Stonewall. The power plant will be located about 16 miles north of Ada, Okla. J. J. McKanna, of Oklahoma, Okla., is president of the company.

KINDERHOOK, N. Y.—The Kinderhook Electric Light Company has been chartered with a capital stock of $1,000 by John B. Gose, Hiram S. Churchill and Charles J. Gose. The company proposes to operate a light, heat and power plant.

COLUMBUS, OHIO.—Articles of incorporation have been filed for the Columbus, Mt. Vernon & Mansfield Railway Company with a capital stock of $10,000 for the purpose of building an electric railway connecting Columbus and Mansfield, via Mt. Vernon. The directors are: J. W. Lehman, J. M. Adams, David Lehman, Thomas W. Varley and George W. Rhodes.

PRINEVILLE, ORE.—The Cove Power Company has filed articles of incorporation with a capital stock of $50,000 for the purpose of constructing a hydroelectric power plant on the Crooked River at Cove Orchard. The present plans call for the erection of a dam and a canal to carry the water a distance of 2280 ft. to the generating plant where, it is estimated, that about 6000 hp can be developed. The directors are: W. A. Booth, president; Warren Brown, secretary and treasurer; D. F. Stewart and G. M. Cornett.

PITTSBURGH, PA.—The Pittsburgh, Steubenville & Wheeling Street Railway Company has been granted a charter to construct an electric railway from Pittsburgh to Steubenville and Wheeling. A railway will also be built between Dormont and Bridgeville, four miles in length. The company is capitalized at $40,000 and the incorporators are: W. E. Hildebrand, Oliver Building, Pittsburgh, Pa., president; John F. Klein, of Carnegie, Pa., and C. W. Behney, of Cecil.

GREER, S. C.—The Fairview Telephone Company has been chartered with a capital stock of $2,000 by W. D. Cox, C. Ballenger and I. P. Few.

NASHVILLE, TENN.—Articles of incorporation have been filed for the Eastern Tennessee Power Company with a capital stock of $1,750,000 for the purpose of development of water power to generate electricity. The company has secured rights of way from Chattanooga to near Parksville on the Ocoee River, where a large power plant will be erected.

SALT LAKE CITY, UTAH.—The Utah & Salt Lake Electric Railway Company has been organized to construct an electric railway to connect Salt Lake City and Payson, a distance of 70 miles. The company will be capitalized at $1,500,000. Simon Bamberger, Stephen Chipman, James A. Clare and others are interested in the enterprise.

BUFFALO RIDGE, VA.—The Buffalo Ridge Telephone Company has been granted a charter with a capital stock of from $1,000 to $5,000. The incorporators are: C. A. DeHart, of Buffalo Ridge, Va.; J. A. Nolen, of Elamsville, Va., and J. B. Brammer, of Woolwine, Va.

RICHMOND, VA.—The Richmond Power Company has been granted a charter with a capital stock of $500,000. The company proposes to erect a power plant near the coal mines at Midlothian and transmit electricity to Richmond, Norfolk and other points. It is understood that the initial installation will develop about 10,000 hp. The incorporations are: S. Dabney Crenshaw, of Richmond, Va.; Levin Joynes, of Richmond, Va.; F. W. Meulen, of New York, N. Y., St. John Clarke, of New York, N. Y., and Henry Twombley, of New York, N. Y.

ADRIAN, WASH.—Articles of incorporation have been filed for the Adrian Power & Water Company with a capital stock of $457,000 by E. P. Colman, H. Lessing and H. W. Mangoad.

HUNTINGTON, W. VA.—Articles of incorporation have been filed under the laws of the State of Delaware by the Cincinnati & Pittsburgh Electric Railway Company with a capital stock of $1,000,000. The incorporators are: A. E. Cox, F. S. Kanode and C. R. Wyatt, of Huntington, W. Va. The company proposes to construct and operate electric railway from Cincinnati, Ohio, to Pittsburgh, Pa.

ELDERON, WIS.—Articles of incorporation have been filed for the Elderon Telephone Company with a capital stock of $10,000 by A. J. Plowman, F. E. Bump and H. H. Manson.

Personal.

SIR J. J. THOMSON, F.R.S., has been elected president of the (British) Junior Institution of Engineers.

SIR WILLIAM CROOKES, the famous chemist, has been given the order of merit by the British Government.

DR. AUGUST RAPS, of the technical staff of Siemens & Halske, Berlin, has received the honorary degree of Doctor of Engineering from the Dantzig Technical High School.

MR. CLAUDE L. DAWSON, secretary of the Anderson Traction Company, has resigned his position with that company, to go to Puerto Cortez, Honduras, as United States Consul.

MR. JOHN S. PECK, consulting electrical engineer of the British Westinghouse Electric & Manufacturing Company, Manchester, England, is visiting this country in the interest of his company.

MR. E. W. STEVENSON, electrical engineer of the Hazard Mfg. Co., Wilkes-Barre, Pa., sailed for England on the White Star liner *Adriatic* on Wednesday, July 27, for a vacation for seven weeks.

DR. JOHN B. WHITEHEAD, formerly associate professor in the department of applied electricity at the Johns Hopkins University, has been appointed professor of applied electricity in that institution.

MR. VICTOR F. GATES has resigned from the Pittsburgh office of the Sprague Electric Company to take up the sale of American Conduit and Wireduct in the South, and will locate in Atlanta, Ga. He will be succeeded by Mr. H. Lee Reynolds, formerly of Doubleday-Hill Electric Company.

MR. ROBERT J. CHAMBERS, general manager of the Montgomery, Ala., Light & Water Power Company, delivered an address last week before the Business Men's League of Montgomery, in which he very plainly pointed out existing conditions which hampered the progress of the city. To emphasize a plea for closer co-operation, Mr. Chambers made a donation of $1,000 to the funds of the League.

MR. CHARLES M. NININGER, an Atlanta resident for a number of years, and connected with the Southern Bell Telephone Company there, has recently been promoted to the office of manager of the local Bell Telephone Company's exchanges, with the official title of district commercial manager. Mr. Nininger succeeeds Mr. A. H. Marchant, who has resigned his position with the Atlanta exchanges. Mr. Nininger, who will have supervision of more than 15,000 telephones, has been special agent to the superintendent of the first division, comprising the State of Georgia, and also held a similar position in Alabama, prior to which he was manager of the Montgomery exchange. He also served as special agent and chief clerk in the auditor's office after coming south from Baltimore, having been with the company since 1905.

Obituary.

MR. EDWARD ATHERON BESSEY, instructor in electrical engineering in the Colorado State Agricultural College, died at his home in Fort Collins on July 12. Mr. Bessey was 35 years of age and a graduate of the University of Nebraska. He had been in the employ of the Stanley Electric Company and General Electric Company at Pittsfield, Mass., the Denver Gas & Electric Company and the Central Colorado Power Company before taking a position in the Colorado Agricultural College last fall. He leaves a widow and a son two years old.

MR. JOHN DENISON EVARTS DUNCAN died at Ann Arbor, Mich., on July 13, at the home of his mother. Mr. Duncan was born at Union Falls, Clinton County, N. Y., in July, 1871, and, with his parents, moved to Ann Arbor, Mich., in 1879, where he lived until the completion of his technical education. Upon graduation in 1889 from high school, he entered Michigan University and was graduated from the School of Engineering in 1893, receiving the degree of Bachelor of Science in Mechanical Engineering. The following year was spent in post graduate work at Cornell University, from which he received the Master's Degree in Mechanical Engineering in 1894. From 1894 to 1896 Mr. Duncan was employed by the Terre Haute Street Railway Company, Terre Haute, Ind., and the Stanley Electric Manufacturing Company, of Pittsfield, Mass., With the latter company he was associated with Mr. Stanley and Mr. Chesney in their extensive experimental work connected with the solving of high tension problems which were first studied at their factory. On leaving the Stanley Electric

MR. J. D. E. DUNCAN.

Manufacturing Company, Mr. Duncan successively held engineering positions in New York with the Metropolitan Street Railway Company; Western Electric Company; New York Telephone Company; Westinghouse, Church, Kerr & Company; and Consolidated Railway Electric Lighting & Equipment Company. On his return from a trip to Alaska on engineering work connected with a mining enterprise, Mr. Duncan entered, in February, 1901, the employ of Sanderson & Porter as managing engineer of their New York office. While directing the engineering work of this firm Mr. Duncan had been in responsible charge of the design and execution of many large and diversified engineering projects. By all who knew him and his work he was considered to be an engineer of exceptional ability and sound judgment. When taken ill Mr. Duncan was returning from a business trip of investigation and inspection made in the far west where he had gone to examine electrical properties for which his firm is acting as consulting and constructing engineer. Mr. Duncan was a life member of the American Society of Mechanical Engineers, a member of the American Institute of Electrical Engineers, the Brooklyn Engineers' Club, the Engineers' Club of New York, the Machinery Club of the City of New York, the Masonic order, the Michigan Club of New York, the University of Michigan Club, and the Cornell University Club. In 1901, Mr. Duncan married Miss Lena Hill, of Lyons, N. Y., who, with his mother and two brothers, survives him.

Trade Publications.

AIR HEATERS.—Much valuable information concerning "hot blast" heaters is given in bulletin No. 273 of the American Blower Company, Detroit, Mich.

ARMORED HOSE.—In its booklet No. 517, the Sprague Electric Company, 527 West 34th Street, New York, discusses the advantageous features of flexible steel armored hose for conveying air, water or steam under pressure.

MECHANICAL REFRIGERATION.—Brief descriptions are given of refrigerating apparatus particularly adapted for operation by means of electric motors in an illustrated catalog and price list issued by Fred W. Wolf, 301 Fisher Building, Chicago, Ill.

ELECTROPLATING DYNAMOS.—A bulletin recently issued by the Lincoln Electric Company, Cleveland, Ohio, gives an outline of the requirements of a successful electroplating generator and then offers a machine which involves several new features. One type is built without a commutator.

MINE TELEPHONES.—In bulletin No. 1110 of the Western Electric Company are given numerous illustrations and descriptions of telephones and signal apparatus for mines. The apparatus treated has been designed for use in a combined system of party-line code ringing telephones and emergency signal bells.

INSULATORS.—Much information relating to transmission-line insulators is contained in Catalog No. 2 of the Pittsburgh High-Voltage Insulator Company, Derry, Pa. The weight, height, diameter test e.m.f. and working e.m.f. are given in full for a line of pin-type insulators designed for circuit e.m.fs. up to 66,000 volts.

AUTOMOBILE ELECTRIC LIGHTING.—The Stuart-Howland Company, 1 Winthrop Square, Boston, Mass., has issued an illustrated circular giving particulars of an equipment for lighting automobiles by means of electric lamps receiving energy from storage batteries. A separate booklet deals with the batteries for this service.

ELECTRIC WIRING MATERIAL.—The H. T. Paiste Company, Philadelphia, Pa., has issued its condensed Catalog No. 16, which, being intended chiefly for reference, contains merely brief descriptions, illustrations and price lists of electric light wiring material. Among the new devices shown are special forms of wall sockets, receptacles, pipe taplets, molding taplets and sign receptacles.

SEWING-MACHINE MOTORS.—A publication of interest, especially to the housewife, has been issued by the General Electric Company, entitled "Sewing Machine Motors." The Bulletin, which is No. 4727, illustrates and describes in more or less detail two types of sewing-machine motors which may be easily applied to any of the standard sewing machines of either the drop-head or the stationary-head type. These motors are intended for ordinary domestic use, and are made for alternating current and direct current of standard voltages.

BUSINESS NOTES.

RIDGWAY ENGINES.—Of a large number of four-valve engines recently sold by the Ridgway Dynamo & Engine Company, Ridgway, Pa., two (28 in. x 32-in.) were ordered by the Susquehanna Railway, Light & Power Company, of Wilkes-Barre, Pa., and one (12 in. x 16 in.) by the Nittany Light, Heat & Power Company, State College, Pa.

THE PHŒNIX ELECTRIC COMPANY, of Mansfield, Ohio, is now represented in the Chicago district by Mr. Alvin Fox, 1249 La Salle avenue, formerly with the Allis-Chalmers Company. The company makes both alternating and direct-current motors from ⅓ to 50 hp and pays particular attention to motors designed for elevators and machine-tool drive.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED JULY 19, 1910.

[Conducted by W. F. Bissing, Patent Law, 2 Rector St., N. Y. City.]

964,498. ELECTROMAGNETIC PROPELLING SYSTEM; R. Dean, Findlay, Ohio. App. filed Jan. 28, 1907. The vehicle carries electromagnets and a controller, and the roadbed carries soft iron bars spaced apart. When energized the magnets pull the car by their attraction for the soft iron bars.

964,503. ELECTRICAL MUSICAL INSTRUMENT; I. Engstrom, Chicago, Ill. App. filed July 14, 1909. Bells are rung by electrical means controlled by the finger key.

964,513. INTERCOMMUNICATING TELEPHONE SYSTEM; W. W. Hawkins, Cleveland, Ohio. App. filed May 9, 1906. A series of selective push-buttons for giving the signal, the buttons at each station being held in their operative positions, thus controlling the talking circuit and automatically release when the receiver at the station is hooked up.

964,521. HOT WIRE ELECTRICAL MEASURING INSTRUMENT; J. T. Irwin, London, Eng. App. filed May 25, 1907. Polarizes the wires of the instrument from the current supply to be measured and compensates for the heat capacity of the wires by employing condensers or inductive resistances.

964,530. TRACK INSTRUMENT FOR SIGNALING SYSTEMS; T. MacDougal and J. McK. Chambers, Boulder, Col. App. filed April 20, 1909. The passing train closes a circuit to operate the signal, this being effected through a lever system, and a circuit closer being controlled by clockwork.

964,536. ELECTRIC SWITCH; W. S. McLewee, Yardley, Pa. App. filed Feb. 13, 1909. Slidably mounted switch, including a base and socket to receive a cutout.

964,552. WIRE STRETCHER; J. H. Rager, Vintondale, Pa. App. filed Feb. 11, 1910. For trolley wires, including a body bar with grooves in which the wire is secured, a central standard carried by the bar and having a yielding engagement with the trolley wire.

964,566. MANUFACTURE OF ALUMINUM AND ITS ALLOYS; H. F. D. Schwahn, Belleville, Ill. App. filed Dec. 7, 1908. Electrolytic process of making aluminum by combining at a high temperature sulphite of aluminum with carbon and then electrolyzing.

964,569. RAILWAY SIGNALING DEVICE; P. H. Shue, Denver, Col. App. filed June 9, 1909. Semaphore type controlled by an electromagnet, which controls a pendulum escapement to actuate a transmission mechanism to revolve the semaphore.

964,586. INSULATOR; J. R. Tufts, Jr., Weymouth, Mass. App. filed Nov. 29, 1907. An inner member having a support and a cavity with an annular coiled clamping jaw and an outer member sliding in the cavity having lined orifices.

964,592. FUSE; F. H. Weston, Jr., Schenectady, N. Y. App. filed April 10, 1902. A cartridge fuse comprising a sinuous strip of fusible metal surrounded by non-conducting absorbent material.

964,612. IMPULSE TRANSMITTER FOR ELECTRIC SIGNALING SYSTEMS; E. E. Clement, Washington, D. C. App. filed Nov. 1, 1906. For sending groups of numbers by means of a number wheel controlling a contact and a plurality of short-circuiting devices cooperating with the wheel to determine different numbers of impulses.

964,619. ATTACHMENT PLUG; J. C. Dallam, Schenectady, N. Y. App. filed Jan. 11, 1905. For incandescent drop lights or plugs, including a one-piece base carrying recesses receiving contact clips with center and side contacts at the other end of the base connected to the clips.

964,622. TELEPHONE RECEIVER; W. W. Dean, Elyria, Ohio. App. filed March 7, 1910. The instrument is encased in a metal shell, the walls of which are folded at the open end to form an abutment for the receiver support.

964,630. DYNAMO-ELECTRIC MACHINE; J. P. Feeney, Schenectady, N. Y. App. filed April 6, 1908. For supporting end turns against centrifugal force by means of a row of members, each having a flange engaging the exterior of a single end turn and secured by a single stem.

964,654. INTERLOCKING SAFETY MECHANISM FOR CONTROLLING DEVICE; F. H. Kittredge, Joliet, Ill. App. filed May 17, 1909. For power lines, including a movable circuit-closing member, a blocking member and a connection between so as to hold the movable circuit-closer open after movement.

964,659. MEANS FOR OPERATING AND CONTROLLING SINGLE-PHASE ALTERNATING CURRENT MOTORS; B. G. Lamme, Pittsburgh, Pa. App. filed May 19, 1909. Single-phase alternating commutator motor with series connected armature and field and means for supplying variable voltages to the motor and for causing the ratio of the amount of current which traverses the field to that which traverses the armature to vary as the voltage applied.

964,664. ARC LAMP; G. M. Little, Pittsburgh, Pa. App. filed May 6, 1907. For composite electrodes with intake side apertures with portions bent so as to direct drafts of air into the casing.

964,665. STARTING DEVICE FOR ELECTRIC LAMPS; G. M. Little, Pittsburgh, Pa. App. filed May 6, 1907. For avoiding the slag on the electrodes by moving the electrodes into and out of engagement to establish the arc by electromagnetic mechanism.

964,666. CASING FOR ARC LAMPS; G. M. Little, Pittsburgh, Pa. App. filed May 6, 1907. For ventilating arc lamps by means of a chimney tube projecting between parallel plates.

964,667. GUIDE AND HOLDER FOR ARC LAMP ELECTRODES; G. M. Little, Pittsburgh, Pa. App. filed May 6, 1907. For supporting and guiding a movable electrode, the electrode holder having a stop with a guide, the stop being automatically thrown out of alignment with the guide at one end of its travel.

964,687. BATTERY AND HOLDER; G. L. Patterson, New York, N. Y. App. filed May 26, 1908. Dry battery holder, including two socket members anchored in an insulating head, the sockets and terminals being non-symmetrical, to prevent reversal of polarity.

964,691. ARC LAMP; R. Fleming and C. A. B. Halvorson, Jr., Lynn, Mass. App. filed Jan. 16, 1906. Flaming arc lamp making use of a chimney for ventilating and a special form of feeding mechanism consisting of clutches and levers for feeding the electrode.

964,692. INCANDESCENT ELECTRIC LAMP; E. W. Rice, Jr., Schenectady, N. Y. App. filed Sept. 13, 1907. For supporting against rough handling, by holding the loop under spring tension and providing auxiliary anchors for preventing transverse vibration.

964,710. ELECTRIC SIGNALING SYSTEM; J. D. Taylor, Edgewood Park, Pa. App. filed April 28, 1908. For electric roads in which

964,586.—Insulator.

the rails carry propulsion and signaling current. Makes use of signal controlling relays and conductors in inductive relation to the track rails.

964,711. ELECTROMAGNETICALLY OPERATED SWITCH; J. F. Tritle, Schenectady, N. Y. App. filed July 1, 1908. For power circuits. Makes use of an E-shaped frame for the field to carry the coil and parts.

964,714. ALTERNATING CURRENT MOTOR; P. Utne, New York N. Y. App. filed March 25, 1909. The rotor is of non-magnetic metallic material and the field coils are supplied with alternating currents in the windings of two opposite magnets.

964,737. INSULATED DISTRIBUTER FOR ELECTRIC SERVICE WIRES; J. B. Ashley, Seattle, Wash. App. filed July 14, 1909. An insulating casing surrounding a wired distributing support, with a plurality of divisions carried by the casing to receive a plurality of wires.

964,741. CONTACT FORMER OR LINE TAPPER; C. A. Beghtol, Canon City, Colo. App. filed July 3, 1908. For ceiling blocks and the like, including an attaching shank carrying a head and an insulation cutting blade carried by the head.

964,742. DYNAMO ELECTRIC MACHINE; B. A. Behrend, Norwood, Ohio. App. filed Dec. 23, 1904. Double commutator machine with positive and negative collecting devices for each commutator, the positive collectors of one commutator having a greater resistance than the negative and the positive collectors of the second commutator having a less resistance than the negative collector of the second commutator.

964,751. MOTOR CONTROL; E. R. Carichoff, Schenectady, N. Y. App. filed April 27, 1908. A main switch for the motor circuit, a circuit changing switch, a signal magnet for both switches and a selective magnet for controlling its action with a master controller for controlling both magnets.

964,759. ELECTRIC HEATER; A. S. Cubitt, Pittsfield, Mass. App. filed Feb. 16, 1910. For supporting the heating element or plurality of coils, by an intermediate support common to the coils and electrically connecting them at equi-potential points.

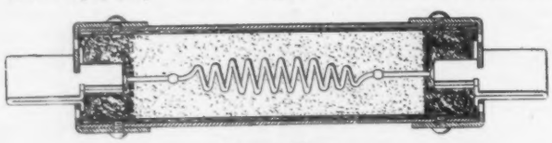
964,760. ELECTRIC CURRENT INTERRUPTER; P. B. Cumings, Fremont, Neb. App. filed Aug. 28, 1908. For leading sneak currents to ground through a fuse by means of a clamp and spring, together with a pivoted member engaging the clamp and spring to clamp the conductor.

964,770. DYNAMO ELECTRIC MACHINE; J. P. Feeney, Schenectady, N. Y. App. filed Dec. 29, 1909. For supporting the end turns against centrifugal force by members having interlocking portions.

964,793. METHOD OF OPERATING AND CONTROLLING SINGLE-PHASE ALTERNATING CURRENT MOTORS; B. G. Lamme, Pittsburgh, Pa. App. filed July 9, 1906. The method of regulating an alternating current motor with series connected armature and field coil by adjusting the speed steps and causing the ratio of field circuit turns to armature turns to vary directly as the speed.

964,794. SYSTEM OF CONTROL FOR ELECTRIC MOTORS; B. G. Lamme, Pittsburgh, Pa. App. filed April 5, 1907. For commutator alternating or direct current motors, with means for adjusting the connection between the field and armature windings so as to have few turns on the field coil when operating on alternating current and a larger number for direct current.

964,798. ELECTRIC SWITCH; C. F. Lewis, New York, N. Y. App. filed May 31, 1906. For securing a quick break in a push switch.



964,592.—Fuse.

Includes a sliding rod on which a contact member is slidably mounted, and a stop on the rod limits its movement. A pair of springs grip and hold the sliding contact until their pressure is overcome by the movement.

964,819. LOOSE MOTION DEVICE FOR ELECTRIC CONTROLLERS; R. Van R. Sill, Newark, N. J. App. filed June 10, 1909. A rotary drum carrying a star wheel coacting with a pawl and a pair of jaws held closed by a spring, one of which is connected to the star wheel, so as to avoid holding the controller at a point which would produce an arc.

964,830. SYSTEM OF ELECTRICAL DISTRIBUTION; J. L. Woodbridge, Philadelphia, Pa. App. filed July 29, 1909. For storage batteries in parallel with generators controlled by an electrolytic valve which prevents operation of an electro-magnetic regulator in one direction.

964,836. AUTOMATIC SWITCH; C. R. Austin, Longbeach, Cal. App. filed April 30, 1907. For automatic telephone systems for selecting one of a number of trunk lines by means of a series of fixed contacts, an arm carrying a movable contact, a reciprocating electrical contact for moving the arm and a stop controlled by another electromagnet.

964,858. METHOD OF OPERATING ELECTRIC MOTORS; B G. Lamme, Pittsburgh, Pa. App. filed May 3, 1904. For commutator types of motors driven by alternating or direct current. The field coils are connected for each of a plurality of lower speeds, so that only a portion of the total current traverses the field coils while the total current traverses the armature.

964,863. SEPARABLE ATTACHMENT PLUG; H. Hubbell, Bridgeport, Conn. App. filed Aug. 25, 1909. A screw shell with a groove above the thread and an attachment plug having a shell with a slot and spring in the slot and having attaching portions engaging the groove in the shell.

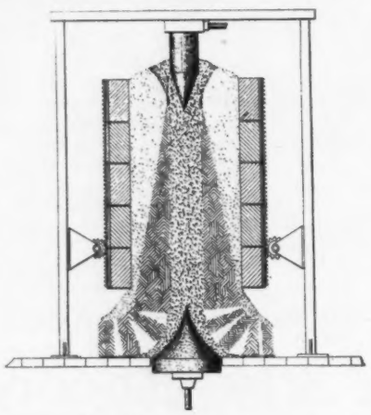
964,892. DAMPER REGULATING MECHANISM; B. C. Wickes, Auburn, N. Y. App. filed Dec. 9, 1909. A fluid pressure device for controlling a damper, the former connected to a water main and controlled by a valve operated by an electromagnet.

964,953. CURRENT DISTRIBUTING AND COLLECTING MECHANISM FOR ELECTRIC RAILWAYS; F. G. Clark, New York, N. Y. App. filed Oct. 7, 1908. A catenary support for connected rails with means for adjusting them vertically and horizontally in combination with a trolley having a two-face tube supported on a universal joint carried by an arm connected to the car.

964,961. CABLE CONSTRUCTION; H. W. Fisher, Pittsburgh, Pa. App. filed March 24, 1910. For detecting the temperature within the cable at a remote point by means of a thermo-couple contained within the cable at said point.

964,969. ELECTRIC WIRE COUPLING; A. H. Hesterhagen, Jersey City, N. J. App. filed April 14, 1910. A base plate of non-conducting material with a metallic coupling on the back having an anchor and screw holes together with a cap of non-conducting material fitting over the base.

964,994. STORAGE BATTERY INDICATOR; P. M. Marko, New York, N. Y. App. filed Dec. 14, 1909. A shunt circuit permanently carried within the storage battery casing, and including a constant resistance



965,142.—Method of Making Silicon Carbid.

equal to the normal load thrown in circuit when short circuiting the battery to test its strength with a voltmeter in parallel.

964,995. STORAGE BATTERY; P. M. Marko, New York, N. Y. App. filed March 8, 1910. An electric meter within the opening of a storage battery casing.

965,017. SELECTIVE SIGNALING SYSTEM; H. O. Rugh, Sandwich, Ill. App. filed Feb. 15, 1909. For railways to call up selectively stations from the central office by means of step-by-step selectors at the sub-station with electromagnetic means for operating them.

965,028. RAILWAY SIGNALING APPARATUS; P. H. Shue, Denver, Col. App. filed May 17, 1909. Track instrument actuated by a train to close the circuit to operate a semaphore.

965,059. CURRENT REGULATOR; V. G. Apple, Dayton, Ohio. App. filed Dec. 21, 1908. A pile of carbon plates arranged in a circuit with an electromagnet for controlling the pressure. Details.

965,960. SPACE TELEGRAPHY; C. D. Babcock, New York, N. Y. App. filed July 17, 1907. An oscillation producer in which the discharge is muffled, having electrodes, one of which is provided with a plurality of points contained in a vessel holding gas under pressure. The electrode is rotated.

965,062. CHOKE COIL; H. J. Beck, Philipsburg, Pa. App. filed Sept. 2, 1909. An angular core carried by a standard on which coils are slidably mounted.

965,084. MEANS FOR TRANSMITTING POWER; C. Cleiren, Brussels, Belgium. App. filed Jan. 19, 1909. Speed reducing gear in which the first speed is obtained by connecting the motor with the wheels, so as to give the maximum motor couple and as the resistance diminishes the power of the motor is transmitted electrically to the wheels so as to increase the speed.

965,103. ELECTRICAL CONTACT; G. W. Goodbridge, Bridgeport, Conn. App. filed May 11, 1910. Center contact for plug receptacles in which cup members one inverted within the other are used, with a spring for separating them.

965,123. INSULATOR; C. Smithson and J. W. Osborne, Winchester, Ill. App. filed Sept. 23, 1909. An insulator having a hood, together with a support fitting within the hood with a central threaded stem.

965,139. STARTING DEVICE FOR ARC LAMPS; G. M. Little, Pittsburg, Pa. App. filed Sept. 3, 1907. An electromagnet winding, with a switch for governing a shunt thereto, a thermostat for the switch with a conductor in series with the winding an armature carried by the switch and actuated by the magnet.

965,142. METHOD OF MAKING SILICON CARBID; F. J. Tone, Niagara Falls, N. Y. App. filed Jan. 7, 1909. A continuous process in which a charge of silicious and carbonaceous material surrounds a core of conducting resistance material. The resistance and charge are moved during the passage of the current, and renewed.